OPEN AIR

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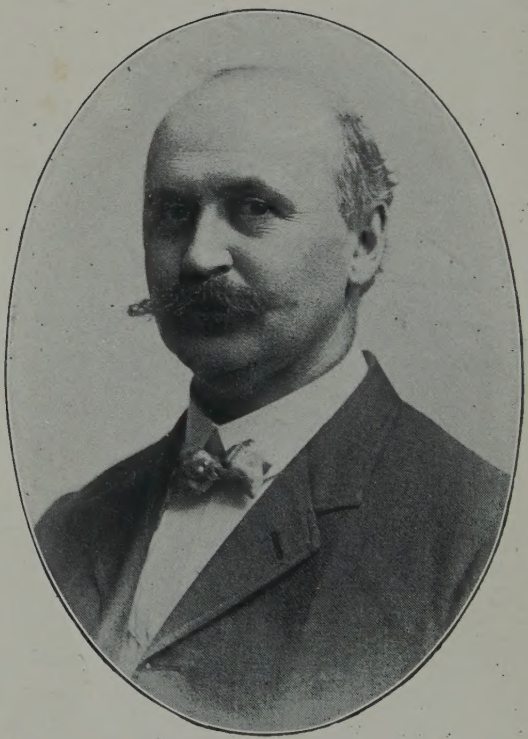

WILLIAM E. WATT.

CAT.

OPEN AIR

A STATEMENT OF WHAT IS BEING DONE AND WHAT SHOULD BE DONE TO SECURE RIGHT AIR IN HOMES, SCHOOLS, OFFICES, FACTORIES, CHURCHES, ETC.

BY

WILLIAM E. WATT, A. M., Ph. D.

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PREFACE.

To produce vitality and efficiency in adults and children seems to me the greatest kind of work. In these pages are shown what is actually being done in this important line. By emancipating children from being required to learn where the conditions produce disease and prevent learning, we are of real use in the world. By showing adults how they may be well and efficient we help the social and business world. By inducing the people of our country to rear their children so they will be well and strong instead of thin-blooded, suffering, and weak, we render patriotic service. By helping those who have the care of souls to do their work without the active opposition of nature, we aid the church.

Nobody would believe it wise to feed a child predigested food. We are all agreed that the teeth, the salivary glands, the stomach, and its juices should do their work in building up human growth. In other words, we think the child who is well should be permitted to continue well because properly exercised along the digestive tract.

No sane person would argue that the growing child should not use his muscles. We know well that only by exercise is hardness attained. More than this, the member that is not exercised loses its power.

Nobody believes, either, that a child should be kept perfectly warm at all times. There is no one so fond as to think he should keep the air about his child blood warm for fear the child might take cold.

But in practice this thing is pretty largely done. I mean the warming of a child is regularly overdone in all well-to-do families. Most modern houses are kept too warm. All modern schools are kept too warm and too dry. All children who can afford it have too great an abundance of underwear and wraps.

A dry skin is a safe skin. A skin not permitted to cool off enough to get dry during the day is a dangerous skin. It makes the patient tender and susceptible to drafts and colds. But mothers frequently swelter their children with wool and silk and fur to make them immune to colds, rheumatism, and pneumonia! Science has shown us that this is the very surest road to these diseases. The children under ordinary conditions who suffer these afflictions are the very ones who have been coddled.

Many children, and adults as well, are but half alive because of wrong air. Let us live while we live. Let us learn to use the air aright and so increase our vitality, length of days, immunity to disease and pain, mental and physical efficiency, and our ability to avoid ill-nature, morbidity, envy, malice, and all uncharitableness.

I believe our people are about to add from ten to twenty years to the average length of life in the United States, decrease the ranks of poverty and crime, add several inches to the average of stature, and advance materially in virtue and happiness.

W. E. W.

Chicago, Illinois, June 30, 1910.

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CHAPTER I.

Chills and Dampness.

In the Chicago schools we are accustomed to what is considered the best scientific ventilation system in the world. Air is thrown into the schoolrooms in sufficient volume to satisfy the most rigid requirements. The air is of the right temperature too, for it comes from two chambers, one of which is warmer than we wish the schoolrooms and the other a little cooler.

A thermostat causes a damper to trip when the temperature rises and cooler air enters until the damper is tripped the other way and warm air is required. This gives us a fluctuating temperature between the limits set by rules of the board of education, 65 and 70 degrees Fahrenheit.

When the system was perfected it was supposed to give all that modern science could demand. But in practice it has serious weaknesses. In the first place, the amount of air delivered to the rooms seems right because it has been measured in every instance and dampers set to keep that amount going to that particular room. But although the air is delivered overhead in the rooms and goes out near the floor in the dressing room, it has been discovered that air so shot through a room does not really ventilate every part of the room,

for some parts get a breeze through them while others have the air merely turned over, traveling as water goes round in a whirlpool.

A second defect is that it requires the windows of the rooms and all doors to be kept closed tight. Even when this is perfectly done, the currents of air outside the building vary to such an extent that the room which received the exact amount of air demanded on the day the tests were made, now gets much more air or much less, the pressure outside the house governing the matter. Then the thermostats which work automatically do not always succeed in getting delivered to the room exactly the degree of temperature they are set to secure. Sometimes, in spite of the best efforts of the engineer, a room is too cold or too warm, and the apparatus will not take care of the trouble. So it happens in actual practice that many rooms are heated much above 70 in order to get warmth enough into other rooms.

Humidity is an important factor—We have found by a long series of tests at the Graham school that humidity is of more importance than temperature. This is difficult for the ordinary man to understand at a glance, for he will be puzzled to find that we have schoolrooms in which all present are comfortable and the temperature in the rooms ranges from 35 to 65. To make it clear, let me first explain why one sometimes is cold or chilly in a temperature over eighty.

An engineer tells me that he comes sometimes into his boiler room when the temperature is over 90 and feels a distinct chill there. There are teachers who complain if the temperature falls below 75, and others who complain when it reaches the low mark of 70. I do not know of any American school where the ordinary temperature is kept under 65 except the Graham.

Air that is heated requires moisture. There is a steam vacuum in air that has been taken from outdoors at a low temperature and raised to the temperature required for school or living room purposes. This warm air is dryer than that of any known climate in the world.

What does it do to the human body? It begins at once to draw moisture from it as rapidly as possible to supply its moisture vacuum. It takes it through the clothing, from the exposed skin, and particularly from the lining of the nose, throat, and lungs.

Evaporation produces cold. Ice machines are made on this principle. If the evaporation from our skin went on somewhat more rapidly than it does in these warm, dry rooms we should find hoar frost on our skin and perhaps icicles might form in our noses. But the action is more moderate than this, though just as truly productive of cold.

Another serious loss of heat to one in a hot, dry room is caused by the rapid escape of heat through air that is deprived of its moisture. The warmth of the earth is dependent on the moisture in the atmosphere, as all physicists know.

When we step into a room that has too little moisture in its air we begin to lose heat rapidly by radiation, because moist air acts as a fleecy woolen blanket to stop radiation of heat, while hot, dry air takes away our bodily warmth sometimes faster than the warmth of the air hands it back.

Losing heat by these two rapid processes is the cause of our being chilly in a hot, dry room. Bakers walk into large ovens to hang up meat to roast. The heat of the oven cooks the meat, but the workmen go in and out without harm because they lose heat so rapidly from their skin that the warmth of the oven feels good to them.

In fact, they are able to stand this fierce heat for quite a while without much discomfort although it is hot enough to roast a dead ox.

A temperature of seventy degrees in a schoolroom is too much—Every physician will agree with this. But in almost every schoolroom in the northern part of the United States the temperature is fully up to this point and in many schools where children are compelled by law to be in attendance or go to court, the temperature runs far above seventy.

What does this excessive warmth do? It makes pupils sick. It lowers their vitality. It impairs their powers to resist disease. They are made like hothouse plants, ready to succumb to the first assault of the enemy, whatever that enemy may be. It is usually some contagious disease, such as pneumonia, consumption, grip, or other germ disease.

This dry heat assails the mucous lining of the breathing apparatus and causes rapid evaporation there until the lining is destroyed and changed in its texture. This lining naturally secretes a fluid which kills some disease germs, but when it has been destroyed by too much evaporation the lining gives up its office and instead of killing disease germs lets them hang on. This clogs it and instead of being a bulwark against disease, the mucuous lining becomes a host for the culture of germs. It turns traitor to the body, giving aid and comfort to its enemies.

Humidity does not mean dampness—There is a marked difference between humidity and dampness, and one should not expect the same results from damp air as from humidified air. While it is true that air with steam in it is a cloak against cold and keeps the body warm, air

with minute particles of water in it acts in the reverse manner at low temperatures.

I am speaking mainly now of outdoor air, for it is hardly possible to find damp air in a house unless the air is also humid. But in nature in the open, the case is quite different. Let us take the east wind which blows over the city of Boston so much of the year. It has been exclaimed against by visitor and resident until one might believe that it is a great enemy to the well-being of mankind.

Boston's east wind is the ordinary sea breeze which comes upon the land from the water whenever the land air rises and the sea air is enough cooler to rush to take its place. But the sea breeze of Boston comes from the regions warmed by the Gulf stream, and it starts for shore with a great deal of humidity in it. It runs across a strip of cold salt water after leaving the Gulf stream and is made decidedly lower in temperature. This reduces its capacity for steam, or in other words, the lowering of the temperature of the air and the steam it contains makes the steam incapable of riding along mixed in so large a quantity with the cooler air, and so the dew point is reached, and the sea breeze often comes ashore at 100 per cent of saturation. In fact, one scientific gentleman reported to me that he had tested the sea breeze on many occasions with his hygrodeik and found the instrument showing the impossible indication of 104 per cent. He referred the matter to the maker of the instrument and received the rather doubtful reply that probably there were in the atmosphere at the time of its complete saturation to 100 per cent of steam small particles of watery globules which made the hygrodeik tell the story of 104 per cent of humidity.

Whether that is the reason the instrument registered

an impossible percentage or not is immaterial to our purposes, but as I had an opportunity the next day to test a Boston east wind with a hygrometer and found the same remarkable indication on that instrument as well, 104 per cent of saturation, we may let the matter rest with the observation that the wind comes ashore at Boston sometimes with as much steam in it as it can possibly carry, and at the same time it is quite wet with minute globules of water which are not to be reckoned with in estimating the saturation of the air itself, but have to be reckoned with by one who wishes to know why the east wind in Boston seems so chilling when the extremely dry air that drops into that city from the northwest without enough humidity in it to register on any instrument does not seem as biting.

We often hear unscientific persons, in speaking of the beautiful dry air of the extreme northern habitable regions, claim that it is the dryness of the air which makes it tolerable at from 40 to 60 degrees below zero. All who have tested such air are aware that there is almost no humidity in air that is 20 degrees below zero. In fact, there is less than half a grain of steam in zero air when it is fully saturated to the dew point. So the dryness of air below zero is nothing remarkable in its effects on our feelings because the difference between fully saturated air below zero and that which has no steam in it whatever is almost nothing and therefore negligible.

But air below zero may be understood to be dry in the sense that it is entirely free from globules of water even when it is at 100 per cent of saturation and ready to give out some water produced by the condensation of its steam. It is this sort of dryness of the air which makes the low temperature tolerable to man. It is also the opposite of this which makes the disagreeable wet-

ness of Boston's east wind and of the almost unendurable dampness of the air at all times at Singapore. Air that is not only at 100 per cent of steam saturation and at the same time a bearer of a load of minute globules of water which is not in the form of vapor has a very pronounced effect upon the body of man and beast.

At the falls of Niagara I had an opportunity to observe the rare phenomenon of an atmosphere carrying globules of water in great abundance and at the same time not carrying 100 per cent of steam saturation. I went into the mist which rises from the falls and stood where my clothing was becoming rapidly saturated with water from the mist and found by hygrometer test that the air itself which was bringing this water to me was at 78 per cent of steam saturation.

This shows plainly that there are two forms of saturation of air, and because of this there is much confusion in the minds of those who have heard for the first time that the steam in the air produces warmth, for they have a distinct notion that water in the air produces a chill. Air is humidified by steam, but it is moistened by fine particles of water. Since the word saturation applies to air that is full of water and air that is full of steam, confusion arises in most minds until the two ways in which air carries water are recognized.

It is rare that air not at 100 per cent of saturation by steam has in it much water in liquid form. But it may be found at any place where cold water falls far enough to impinge upon the air in such a manner as to throw up large quantities of spray. Sunshine on such spray soon causes it to disappear. It may become so finely divided as to ride away invisible as water, but it is more likely to become evaporated and mix with the air as true steam.

Probably the reason that water in fine particles riding in the air does not immediately evaporate into steam and raise the air to 100 per cent of steam saturation is that wherever evaporation takes place coolness is produced and this prevents further evaporation until the sun or some other warming agency brings the air and water back to the relatively high temperature required for evaporation.

But the Boston east wind is probably nearly saturated before leaving the warm waters of the Gulf stream, and then as it approaches the land loses temperature, it also loses steam, being unable to carry so much in the cooler state, and so dew or fog is formed in the steam saturated air, and the air comes ashore not only saturated completely with steam, but also heavy with minute drops or particles of water.

Such air blowing violently against one's person is sure to cause something of a chill, for it gives one something like the sensation of standing in a brook with much water rushing against him and going by. So it is quite as essential to protect oneself against the east wind as against the rain, for the east wind dampens the clothing and produces a chill unless the person is vigorous and produces heat sufficiently to offset the attack of the wet wind.

Rain is not always attended by 100 per cent of saturation in the air through which it is falling. In fact, it is quite common to find the air rather low in steam saturation at the very time the rain is falling most rapidly, and even when the rain is very fine. The reason for this seems to be that the rain is formed far above and drops through the air we are testing. Not having present enough heat to cause much formation of steam in the rapid descent of the drops, the air is not as much humidi-

fied as one would imagine. A cold rain may fall through air with a very low steam humidity. In the summer it is not unusual, however, to encounter a shower of very warm rain falling through air at 100 per cent of humidity. Such air is particularly oppressive and resembles the air of the tropics in its depressing and suffocating influences. The farmer in the Middle West, however, is particularly pleased with such a rain, for it is then that he asks you to stand silently with him beside the cornfield and actually hear the corn growing.

Naturally dry air, bereft of the last remnant of humidity, is something which we may find in various localities, and its peculiarities will repay the student of meteorology. Within twenty-four hours of the time when I found air in Boston at 100 per cent of humidity, I found a northwest wind blowing into the city the purest imaginable air with not enough humidity in it to make the hygrometer respond in any manner. It seemed to be completely devoid of steam.

We have to admit that the hygrometer is not reliable at all times, and neither is any other instrument for measuring the steam in the air which I have had experience with, and so our calculations need to be taken with a grain of salt, especially when they seem to indicate what is impossible in nature or what seems impossible. But I have found the air of Boston in the time of a northwester practically at 0 per cent of saturation.

It comes from the far North and is a segment of a trade wind dropping back toward the equator from the vicinity of the north pole. In the far North it has been deprived of its steam almost completely, and as it travels southward rapidly it is somewhat raised in temperature, but without opportunity to secure the steam for which it is especially hungry.

Air in motion seems to have a surface tension which prevents its mingling with other currents and layers of air so as to receive from them whatever characteristics they may have which it lacks. And so it happens that a current of absolutely dry air passes between, over, and under other layers of air fully saturated, and in the act of passing, not much of the moisture, if any at all, is imparted to the dry air.

Probably this could not occur if the air were much warmer, but we do know without doubt that this northern air reaches the ground in Massachusetts, and probably at other points, quite cool and bracing and without any perceptible steam mixed with it. If there is any steam in it at all, it is probably the small amount which would be found in air which at 60 degrees below zero has thrown down every bit of steam except an infinitesimal fraction of a grain to the cubic foot, and then passing to the southward it has been raised in temperature 120 degrees Fahrenheit, striking the earth at about 60 above zero, with its capacity for steam saturation increased thirty or forty volumes, and the saturation is practically nothing.

The dangers of the east wind have been magnified, and it will be well here to consider how dangerous comparatively these two extremes of air are to man. The east wind coming in with 100 per cent of steam saturation and a fine collection of minute globules of water, has the grace to carry in its steam charging a protection against the very cold which bites us, and it permits but little radiation of heat from the body. The loss of heat in the east wind is the loss by conduction and by the continued pelting of the body with particles of cold water driven hard by the wind.

But the dry northwest wind dropping in without any

perceptible moisture in it is also cold and bracing. It is pure, for no germs of disease can possibly come from the extreme North. It has no germs of pneumonia in its currents, but it has the peculiar quality of extracting from our bodies much of the radiant heat which they hold. Although there are no pneumonic germs in that air, there are many of them in our throats, and it is possible that the chill one gets almost without realizing it in a northwest wind of this character, may reduce the vitality so that pneumonia will set in.

Both these winds bring vigor and promote resistance to disease. But the clear dry air seems to me to be the one which we should be the more careful to guard against. Only those who are strong should tempt the northwest wind to do its worst. Anyone who is strong enough to defy the east wind without too great discomfort may do so probably with impunity. The fine complexions of those who live where such east winds blow owe thanks to the east wind; but whenever the clear northwest winds fall in upon them they may have a care for their complexions, for the dryness of that air has almost the opposite effect upon the skin.

Schools and offices, churches and homes, where these cool dry winds blow should all be specially guarded against their blighting effects, for when that air is warmed and brought into our buildings, it is the driest air one can find on earth, and it will take large quantities of steam hourly to counteract its parching effects and we shall find ourselves quite chilly in a temperature which ought to feel right, and then the tendency will be to increase the heat, increase the dryness, and make the building more unhealthful still.

CHAPTER II.

The Poison of Fatigue.

We have known for twenty years, or have at least been pretty sure of it, that fatigue is simply the action of a poison in the blood of the weary one. But the recent demonstrations by Dr. W. Weichert, a private lecturer at the University of Erlangen, Germany, have shown that there is a toxin in the blood when we are tired and the system goes at once to work making an anti-toxin for it.

I quote the following from an article on Dr. Weichert's discoveries by H. G. Hunting, in The Technical World:

"Fatigue partakes of the nature of a disease, being itself due to a toxin. Just as in all other cases where such a toxin is produced, there is created, side by side with it, in the human body affected, the antidote, a spontaneous product of nature from materials that she has always in her laboratory. The antidote, if plentiful enough, will counteract the poison and restore the sick body to health. If more than plentiful enough it more than counteracts the poison it fights and becomes a tonic, a sustaining substance that raises the efficiency of the body above that which we are accustomed to consider normal. The experimenter deduced this from the fact that in repeating a given physical exercise, after an interval of rest, the body shows greater capacity than in the initial effort, indicating that there has been an over-

production, for the moment, of the antidote to fatigue caused by the first exercise of the muscles, and that it has become a stimulant.

"Dr. Weichert first discovered the supposed poison of fatigue from the muscles of animals exhausted by weariness. A difficult technical process was necessary to this end, but accomplished its purpose, after considerable experiment. Obtaining finally a highly active substance in crystal form, he found that he could produce a genuine fatigue in creatures inoculated with it. Even death was brought about in some cases by means of such inoculation. By injecting, then, the serum of animals treated with the fatigue toxin into the blood of other animals he found that the latter acquired a surprising faculty of resisting fatigue, and, even when doses of the fatigue toxin, which would have been fatal to the unprotected animal, were administered to those so treated with serum, they showed little or no injury as a result.

"It was simply a matter of aiding, or rather of anticipating nature. When white mice were given daily doses of fatigue toxin, they suffered at first considerably. After a time, however, they began to gain strength and resisting power, proving, according to the scientist, that the spontaneous production of the anti-toxin within their circulation was superabundant for the counter-action of the toxin injections. When the serum obtained from other animals was immediately introduced after injections of the fatigue toxin, the effect was exactly similar. The reasoning was therefore simple, which led to the anticipation of fatigue by the injection of the anti-toxin, and the results seem amazingly to carry out the scientist's hopes.

"The protective effects produced by the injection of anti-toxin are seen in one of the illustrations. Two mice

were treated with the same amounts of poison. The upper one in the photograph had been inoculated with the anti-fatigue serum previous to the experiment, and did not show any signs of fatigue. Its companion presented all the symptoms of extreme exhaustion, was almost asleep, with its hair standing on end, eyes closed, and a respiration greatly slackened, while the temperature of the body also dropped several degrees."

After he had produced his toxin and his anti-toxin of fatigue from the muscles of animals he succeeded in getting the same poison and its antidote by cultures in albumen. He tried them on himself and also upon various animals and got good results. For half a day the strength, or rather, the immunity to fatigue acquired by the use of the anti-toxin, remained in the body and as it is a natural product of the body no nervous after effects were observable.

Now I am far from advocating any use of an anti-toxin for fatigue in growing children. But if there is a toxin in the blood of the tired child and his body has the power of producing, when needed, the anti-toxin for that fatigue, we ought to take advantage of this information in our treatment of children in education and in the management of our own periods of work and play.

Although Dr. Weichert has reported good results from the use of his anti-toxin for fatigue which he names anti-keno toxin, we may afford to wait awhile and see what can be done without the artificially produced antidote, knowing that nature is making one of her own in every tired child's blood. The artificial anti-toxin is now on the market either in powder or fluid state as the purchaser prefers, and for sale at a relatively low cost, but while we know how to produce the stuff in the child and in ourselves without any cost and without the in-

jection of any material from without, we may safely pursue the line of effort which I wish to point out.

The more perfect the resistance of the subject the more readily he throws off fatigue. That is, the more readily he makes enough of the anti-toxin to overcome the toxin of fatigue. This explains why certain persons are not easily tired. It makes clear that persons "born tired" are not to blame for it. It shows the road to follow in order to overcome the depressing fatigues of childhood and to rear strong and intelligent children.

I want to see the natural resistance of the child raised to such an extent that he cannot be made weary with any ordinary exertion. This cannot be done if the child is to sit daily for four or five hours in a dry, hot atmosphere such as kills sagebrush. If he is imprisoned in air that will kill the hardiest cactus, I do not expect him to have any resisting power to speak of.

I expect such a child to require the closest coddling the nursing art can devise. I expect him to keep anxious parents up nights watching to retain the breath in his body. I expect him as a rule to die before arriving at maturity. In fact, if he manages to live and reach maturity and full stature, I do not by any means expect that he will be able to do a man's work in the world. He will be a feeble and inefficient member of society.

Dr. Weichert has discovered that his anti-keno-toxin is good for certain diseases, which have weariness as a symptom. The serum known as tuberculin, with which such good results have been obtained in many cases, contains besides the tuberculous virus proper, poison related to the very toxin of fatigue itself.

Experiments have also shown that animals treated with this stuff offer more resistance to the operations

of the germs of many contagious diseases than those left unprotected.

Children full of the toxin of fatigue cannot learn. They can mechanically obey directions and are too weak to resist the demands of the teacher. They become mere consenters in school and not active originators of work. Rather than have a scene with the teacher they will perform the most unnecessary and purposeless tasks. They will write for hours or even commit passages to memory rather than seem to be disobedient and get a scolding, but they do not retain what they learn in this manner. They get it into the brain by a very tedious process and it does not lie in the mind in condition for subsequent use.

Teaching tired children trains them for stupidity—It not only does them no direct good, because so soon forgotten, but it does them positive injury because it lowers their respect for their own mental powers. Keep a child stupid habitually with fatigue and you make a dunce of him. He believes that he is born stupid. He is unwilling to try to learn anything at all except to perform perfunctorily the tasks which are set him in the school and he permits them to make the least possible impression on his mind.

The school work of the tired child is worse than wasted. We not only waste his time by keeping him in school while tired, but we waste him. We let false notions run riot in his mind. We destroy initiative in him by working him when tired. We prevent his mind from directing itself when we forcibly direct it continuously in weariness.

The poison of fatigue is regularly administered in the schools to children in the mass. They are taught in the mass while partially stupefied. The teaching is of the

feeblest sort even when done in the most approved scientific manner. No matter how engaging the teacher or fascinating the subject, if the child is poisoned or drugged with fatigue at the time, there can be no healthy impression made upon the mind.

We must make a study of getting rid of fatigue in the schoolroom if we wish to become really effective teachers. It is for this direct purpose that the open-air school is devised. Our programs are conducted solely with this in view.

In our low grades at the Graham school we are most of the time fitting children to learn and not spending much time in teaching anything.

Incidentally the children learn a great deal by flashes between their other occupations. In fact, they learn a great deal more than the ordinary class in a warm room taught regularly. They also retain what they learn and find they can use it instantly instead of having to think a long time before making use of what they have acquired.

The absence of fatigue in children taught in open-air rooms causes them to be very quick mentally. Their recitations are of the hair trigger variety and seem to be produced with no mental effort whatever. Instead of the slow guessing and hoping to be correct, which is common in school, we find among these untired children a positiveness which is very refreshing to the educator.

Nobody ever learns anything, except in case of disaster, which he does not have a pressing desire to know at the time of the acquisition. If the children in a class very much desire to know something and are unwearied they will learn quickly and directly. But if they are unable to desire the thing they are very slow to take it in and it remains with them but a very short time.

Whatever one learns is taken in at a flash and needs no repetition, provided the strength of desire is there and the learner is not unwell or poisoned with the toxin of fatigue. Once telling is worth while under such conditions. But the ordinary school curriculum requires many repetitions.

We are reviewing continually in the ordinary school—About ninety-eight per cent of the time of a primary school is spent in trying to secure attention and in reviewing what has been taught before. I have estimated the amount of actual instruction given in the elementary schools in the first four years of a child's life there, provided he gets his promotion every year, which is often not the case—the amount of instruction actually imparted in four years of two hundred days each, four to five hours a day, may readily be imparted by an ordinary speaker in about seventeen hours.

The waste of time in elementary and all school life through not having the entire attention and co-operation of the learning mind is enormous. If we could but find the way to avoid much of the dry reviews and the "hard" study we could control the mental growth of our pupils marvelously.

Because of this need of a better way of lodging knowledge in juvenile minds, the open-air school is finding great favor, for it does the very thing for which there is such crying need. It gets rid of the toxin of fatigue better than any other device ever found. In fact, it is nature's own way of accomplishing this great object.

To fit the child to desire to know is the object of his attendance in the open-air school. Our teachers are repeatedly enjoined not to teach in first grade, and it will be the same in succeeding grades after we have brought pupils forward year after year.

One of the greatest shams in modern education is what is called study. Pupils are put into rooms where study is impossible except in the feeblest and most inefficacious manner and there commanded to improve their minds by independent study. Elaborate plans are laid by psychologists for the teacher to follow in "teaching the children how to study."

Why not tie a cord about the child's throat so he cannot swallow and then "teach him" how to perform the difficult and highly important operation of deglutition? Why not hold before him a teacup of water and give him lessons in the manly art of swimming? Why not blindfold him and give him lessons in landscape painting? It is like training a cat to catch mice with its teeth and claws extracted so that sudden springing and holding on to prey are rendered impracticable.

Study is putting the mind vigorously upon a subject. What is done in school is an effort at putting the mind against a subject or a book on the subject and holding it there by the clock so many minutes. Study is a rapturous getting information by mental and physical investigation. In the ordinary school what is called study is putting the mind against the subject in a feeble attempt to hold it there, most of the effort going into controlling the attention imperfectly.

The act of studying is a succession of triumphs over difficulties. The shout "Eureka!" is frequent where real study goes on. Who ever heard "Eureka!" in the hot, dry schoolroom? It is possible to get up a virtuous resolution in the mind of a student in hot air, and there is often great manifestation of pertinacity, but it rarely is accompanied by any sort of vital force which makes the study real.

We are attempting to fit the mind to desire knowl-

edge. This desire is natural, but when the conditions are all wrong the desire vanishes. Instead of telling my teachers that I expect them to follow a definite program and put in so many hours a week in one subject, so many minutes in another, and so on, to a full program, I tell the open-air teachers who are not teaching children spoiled before by ordinary school methods, "Do not teach these children anything. Do not slavishly follow a timed program. Spend the bulk of the time in fitting them to desire to know. Arouse their curiosity, but not by your pedagogical skill. Do it by permitting nature to assert itself. Thus you will find the mind open and eager to know things. There need be no direct teaching, the mind will find a way of its own far better than the scientific one. Place the subjects of knowledge within reach and permit occasionally some consideration of them, but do not teach little children. Do not explain things at length. Do not permit them to tire themselves with lengthy considerations of things which are not at the time easy for them. Get rid of fatigue. Do not create it continuously.

By getting the children fit to learn, we find it largely unecessary to instruct them. We merely help them occasionally and direct them, but we let the mind do its own finding out at the time when it is most eager and keen for the thing to be learned. It is only the unwearied mind that is capable of learning anything. The tired mind can do what is called studying, and that is the very thing that ought not to be permitted to young children.

That ancient criminal, carbonic acid gas, has been going under the alias of carbon dioxide in late years, but his repute is still bad. Yet I must say a good word for him. He is not as black as he is painted. Recent scien-

tific discovery shows him innocent of the crimes which have been laid at his door. What makes us suffer in a close room is not carbon dioxide. It is the poison thrown off by those in the room who are fatigued.

Dr. Weichert thinks this poison is thrown off by the tired ones by means of their breathing and that others breathing in the toxin thus scattered in the air, become fatigued by intoxication of bad air. Dr. Luther Halsey Gulick presented at Indianapolis some reports of experiments which convinced the members of the Department of Superintendence of the National Education Association that the trouble experienced in bad air is not entirely caused by breathing that air.

He showed that a man breathing good air, having his head outside a box of bad air and his body in it, exhibited the same symptoms regardless of whether he breathed the air in the box or the good air outside. The fact of his body's being inside was sufficient to poison him with weariness.

Probably when Dr. Weichert has experimented further he will find that the toxin of fatigue is distributed in a room where many are gathered, both by breathing and by bodily exhalations. At any rate, the trouble in a badly ventilated room is not caused by carbon dioxide, for it is now well known that we may breathe air that contains from one to four per cent of pure carbon dioxide mixed with the ordinary air and feel no harm. Our ventilating systems are constructed on the principle of calling ventilation a failure if a few thousandths of the air are carbon dioxide while the apparatus is working.

This error of science has set us to trying to blow the carbon dioxide out of our schools and get rid of it in our houses under the impression that we feel better when it is not there. The fact is, we usually feel better

when carbon dioxide is not there to any great extent merely because in clearing out the gas so vigorously we get rid of much of the toxin of fatigue, which has been thrown off by the persons who have also been producing some carbon dioxide by their breathing.

Since it is the toxin of fatigue that we wish to get rid of instead of the harmless carbon dioxide, the problem is a new one. One of the most effective methods is evidently to select the tired persons present and put them out. They are making the others weary. The whole company is acting on every individual to fatigue him, and the longer they remain together and the less there is a change of air in the room the more complete will be the poisoning of the individual.

So it is not really the prosy speaker or the hard lesson or the abstruse subject which makes us tired in an audience or in school. We are making each other tired, and those most tired themselves are doing the worst of the mischief. There are always, or nearly always, a few robust individuals who are unwearied and can stand the tedium better than the rest merely because they are able to make the anti-toxin to prevent fatigue from getting hold on them.

This makes the action of certain teachers more logical than it has seemed in the past when they refused to permit lazy or tired students to remain in the room with them. Without scientific knowledge of what they were doing, they wisely got such undesirables out of the room where they were infecting the rest and sent them to the office of the principal or home to their parents, where they might fatigue them instead of the innocent members of the class who really wished to work.

Aside from the sending away of the fatigued with injunctions to rest up and return when cured of the in-

toxication, there are two means of avoiding the ill effects of a close room. We formerly had but one, to blow out the air and get other air in. Now we know that we may change the air and get some relief and we have at hand a better means of escaping the dire effects of close-room sickness. It is to raise the physical resistance of the students so they may not readily become weary.

Raising the resistance is far more practical and more efficacious than changing the air. If the resistance of the pupils is at such a pitch that they are immune to fatigue they will be able to remain a long time in bad air apparently without suffering at all. More than that, if they are immune to fatigue the sickness attending crowded close quarters will not appear, for there will be no tired individual to infect the others.

If we are right in this reasoning there is far more to be expected from high powers of resistance than from any system of ventilation. I will venture this assertion which I have but partly demonstrated at this writing: Better results in education can be had with one-fourth the standard ventilation if we may have the temperature down to sixty or less and the air properly humidified to make that temperature comfortable to the pupils.

I am not pleading for any less ventilation, but for more attention to fitting pupils physically to resist and not to become weary.

The open-air room is ideal for every purpose of comfort and education—It changes the air very materially. It keeps the temperature low and makes resisting power. It soon puts the pupils into the condition of not knowing fatigue. This makes their minds keen for learning and they learn as easily as ducks acquiring swimming.

The symptoms of fatigue, formerly ascribed to breathing carbon dioxide, are three: Suffocation, lowered tem-

perature of body, and torpor. These are all present in the ordinary school when the air is hot and dry, no matter what the system of ventilation.. They are not present in children who are fortunate enough to attend an open-air school.

We have known these symptoms to be the regular concomitant of the common schoolroom, and yet we have been very tardy in finding out how seriously they defeat the very purposes of the school. Now that we know what causes the trouble and why education is almost physically impossible under conditions of temperature and humidity common to ordinary systems of heating and ventilating, it is our duty to take stock of the trouble we have on hand and get rid of it as rapidly as possible.

We can never hope to get clear-cut thinking from children who are drugged as we are daily drugging practically the population of the United States by our bad systems of housing. The trouble is worse in cold weather than in warm and it is therefore more prevalent in the northern part of the United States than in the southern. But it prevails all over our fair land, and now is the time to remodel our plans and get rid of that which is admittedly defeating our utmost endeavors to teach.

The defeat of school by the atmosphere of school is so common that we have ceased to marvel at it. The fatigue of pupils is such that what they have learned with great pains and much review does not remain long with them. Look at the time spent in "learning" history in the upper grammar grades. It is astonishing how men and women have gone on for years trying in vain to lodge the main facts of history in the minds of children and making so nearly a total failure of the work. Only by segregating a number of facts and reviewing them in the same way in which the multiplication table is acquired, are we able

to fit our pupils to pass an ordinary test on the facts of the history of our country.

That this sort of work is one of the most deadening and fruitless a teacher can engage in goes without saying, but because we cannot make the history work stay in the minds of the children we all resort to it if we expect our pupils to pass any test on the subject at the end of the course.

But whoever knows anything about the action of the mind in acquiring useful knowledge so as to be able to use it readily knows that cramming for an examination is not teaching and has very little to do in developing the mind or informing it for use. An enthusiasm for dates and for short statements of fact from the pages of history may be worked up so as to get the major part of the class to respond rather readily regarding the dry bones of history after due cramming.

But the right way to teach history is to get up a real interest in it. We must get the pupils so intimately acquainted with the great characters in history and so desirous of knowing of their deeds that the history will be learned by contact and not by study. A lively enthusiasm for history makes reading a page of history something like the reading of a page of "Jack the Giant Killer" or something of the sort which gives true pleasure. A discussion of a historic event so as to bring out side lights and cross views of the matter brings exclamations of pleasure and surprise from the class and makes the work delightful to teacher and pupils. But this right method of history teaching is not practiced as much as it deserves, for the teacher has not time to permit her class to enjoy history and run widely over the course. They must be held to a few narrow facts and crammed on them.

Bad air kills our history work and makes us spend the

time which ought to go to teaching the subject broadly and efficiently in the narrowing and fruitless business of cramming.

Hot, dry air kills the language lesson—Few pupils in the grammar schools are mature enough to reason out their work in grammar. But as it is in the course the teacher feels the necessity of "doing something," and she blazes away desperately, knowing that some of the bright ones of the class will succeed in the work and that the majority will miserably fail in some of the simplest details.

It requires a keen mind and some pretty well developed reasoning power to learn grammar. But the children of the grammar grades as a rule have not this equipment. Worse than that, they are kept in such bad air that their minds do not act freely and they are unable to do themselves justice. Consequently most of them give up trying to see the sense in grammar and depend on cramming, much as they previously have done in getting the multiplication table and everything else which they have had to be examined upon.

It is not poor teaching in grammar which makes one-half our population detest the subject to their dying day. It is the fact that they begin to study grammar rather early in life, before they have powers of reasoning or holding abstractions in the mind with any degree of certainty, and they have never been permitted to study grammar in good air when the mind is keen. It is given them in the hot, dry room where they are unable to think, and so it becomes a dismal failure for more than half the population of the United States who have ever got far enough along in school to get much grammar study. There is an equal number of our population who dropped out of school before reaching the severe grammar grades,

and so they have escaped grammar in hot air, but are not sorry, since their experiences in other subjects were so depressing that they were glad to avoid grammar.

The usual air of the school destroys ability to spell—In support of this assertion I will merely quote from Superintendent W. E. Chancellor, who gives us in the Journal of Education of May 5, 1910, a statement of the universal failure of the schools to teach spelling.

"I gave recently a spelling test to 250 eighth grade pupils, city and rural. The test consisted of 100 middle-length words, four to eleven letters. The average was seventy-one per cent. All the words had been taught in class previously. Of the entire number, five secured 100 per cent, sixty-three secured ninety-five per cent or more. Their average age was fourteen years, four months. The words were first read carefully aloud three several times and reviewed once. It was as fair a test as could be given. It was, of course, not 'picked-team' work. Many fell below sixty per cent.

"Five years ago I gave tests that were taken by over 10,000 pupils in grades four to eight; and the average was almost the same—seventy-two per cent.

"It is useless to try to convince business men that our children do in fact know how to spell when an average class misses three words in ten and twenty-eight words in 100 from lists that have been taught and supposedly learned."

This is my arraignment of the public, private, and parochial school systems of the northern part of the United States: We are making children stupid in our arrangements for teaching them. We are giving them headache and catarrh. We are increasing their tendency to swelling glands. We are fostering tuberculosis and all the foul air diseases in our warm, dry schoolrooms, where

true activity of mind and body is precluded. We are preventing the natural action of the mind which makes once telling of any value. We are destroying the ability of the child to think clearly or to believe he has any mental powers to speak of. We are lowering resistance so that many become invalids unnecessarily. We are selling too many short coffins in America. We could better rear most of the children we are burying if we could but give what the children crave and ought to have, activity, right atmosphere, cheerful surroundings, and the ability to exert themselves reasonably without being unduly fatigued.

Our great enemy is fatigue. It is contagious or endemic. Vitality defeats it. Raise the resistance or vital power of the child or the man and you defeat fatigue. Lower it and you invite fatigue. Our present civilization is almost entirely operated to spread fatigue. At home, in church, in office, in school, or on the crowded highway, the conditions are well planned to destroy our lives by means of contagious fatigue.

Let us make war on fatigue and then school work will be improved one thousand per cent. Open air rooms provide the best means of carrying on this warfare.

Feebleness in many cases means death, while strength means ability to survive the present difficulty. Whatever enfeebles the people generally causes many deaths.

Weakness means ignorance, often, while virility may in the same instance be the means of overcoming ignorance, the persistence being supplied which causes the individual to know.

Debility means crime very frequently. When we are too weak to get what we desire by fair means we may be weak enough to take it by foul methods. The weak one sometimes yields to the temptation to crime merely

because he lacks the strength to pursue something in the right way. The lion is called the king of beasts, and he is given the credit by Shakespeare of being too noble to feed upon anything which dies before he strikes it. But those who know the lion in his native haunts assert that the lion is a great carrion eater, especially the weak lion. The man-eater is not the young, vigorous lion, but the old fellow whose teeth are bad, whose limbs are no longer supple, who is too feeble to bring down the zebra by springing upon its back and breaking its neck with one jerk of the paw. Such an old lion will sneak about the village and steal a man in the dark. He is a criminal.

Debility means poverty. He who lacks vitality cannot fight life's battles. He falls in the first onset. He goes down in the struggle for a living. He becomes a burden to the state. One-seventh of the deaths and two-thirds of the cripples are caused by poverty indirectly and directly.

Wrong air destroys vitality—Keeping children where the air is either vitiated or too warm produces the feebleness which means death, ignorance, crime, poverty, and cripples.

Right air makes red bood, steady nerves, clear eyes, dirigible hands and limbs, thinking brains, desire for knowledge, right conduct, and all that we desire for our children. It is the greatest object for which we may set our hearts to acquire for our offspring.

The average criminal is from three to five inches shorter than the average man. He is twenty-five pounds lighter. His chest is three inches less in girth.

If these shortages produce crime, and I belive they do so, you are making criminals in your schoolhouses every day the law compels the child, who wishes to run away, or the child who wishes to come, to remain in the school-

house where the air is not right. Where it is too hot and too dry is the place where life is crippled in these three ways. It is there that you are preparing by due process of law and at great expense boys and girls to become later on the criminals against whom you must proceed, by process of law again, and at great expense, for rape, murder, arson, burglary, and especially highway robbery.

Elaborate statistics have proved that the school children of New South Wales are at almost every age taller, heavier, and of better physique than those of the most robust cities of the old world. At fourteen, the Sydney boy is two and a half inches taller and nearly fourteen pounds heavier than the Glasgow boy, the Sydney girl more than two inches taller and eleven and a half pounds heavier than the Glasgow girl; yet Glasgow is no mean city, no seat of degeneracy or want.

What do they have in New South Wales that is different from what they have in Glasgow? Heavier human live stock, think you? By no means. It is the very same stock, except that to Australia there were shipped some years ago and for a long time, the weaklings from Great Britain, the criminals.

Why does a British population in Sydney grow taller than that in Glasgow? You guess the answer. There is a different way of housing, of schooling, and recreating there. There is more good air injected into the Sydney boy than into the Glasgow youth.

We are seven-fifteenths oxygen by weight. Oxygen is all about us and will add to our stature if we but take thought, or if we do not take thought but quit keeping children after school and preventing little children from playing out in the storm. Land, sea, and sky averaged are 50 per cent oxygen. When oxygen enters, fatigue makes its exit.

CHAPTER III.

Harm Done Directly by Dry Warm Air.

When a horde of disease germs fly into one's mouth or nostrils there is grave danger that some of them may prove fatal. The commonest way that death chooses is to send germs into the system to make the attack from the inside.

Nature provides a way of escape. All the breathing tubes are lined with mucous membrane. This membrane secretes a fluid which destroys germs of all sorts. It simply eats them up, or digests them by a dissolving process.

It is highly important that we keep the mucous membrane of the nose, mouth, throat, bronchial tubes, and the lungs in a good state of health, for this membrane has the important work of guarding the system against millions of deadly enemies, which assail it every day. If anything happens to the mucous membrane so that it does not do this work, we may become ill with one or more of the foul air diseases.

Foul air diseases come from breathing air bearing germs of catarrh, pneumonia, grip, tuberculosis, and others which attack the organs of breathing. It is a wise provision of nature which causes the mucous membrane to secrete its fluids right at the very places where the foul air diseases make their attack.

Now let us examine the action of warm dry air as it comes against the mucous membrane. If such air interferes with the work of this valued sentinel of human health we should be very careful to avoid it, for we cannot afford to permit anything to stop the destruction of these deadly germs of foul air diseases.

Air is said to be saturated with moisture when it has as much as it can carry. When dew gathers on the leaves in the summer evening the cooling air gives up some of the moisture it has carried in the warm part of the day. It is then said to be at 100 per cent of saturation. In the morning the sun warms the air and the dew which has lain on the grass and leaves all night is picked up. It evaporates. The air seems to be hungry for this moisture and takes it up rapidly.

Then the air is not at 100 per cent of saturation, for it is calling for moisture, apparently, and it is taking up whatever there is within its reach. We experience no discomfort when the summer air is at less than 50 per cent of saturation, for natural conditions are usually such that the body enjoys them. In fact, in the winter when the air is at 30 per cent saturation out of doors, we enjoy the cool, clear air and the moisture that it lacks as we breathe it in is readily supplied by the moist linings of our breathing organs, and they are stimulated to gentle and healthful action to supply this moisture. The air seems colder than it really is when we breathe it in and it seizes upon some of the moisture along the mucous membrane. It is as refreshing as a draft of cool water when we are thirsty.

The air out of doors is always right for us to breathe. We need never fear even the night air, for scientists are coming to know that night air is as healthful to breathe as day air, and we should have our windows open

at night to get the full benefit of the natural atmosphere rather than shut ourselves in tightly and breathe the same air over and over. Unless malaria is present night air is good.

The dangerous air that is taking many lives is not night air or summer air. It is the air of winter which is raised by any process to a summer temperature and not supplied with the moisture which goes along naturally with summer air.

When warmed it requires more moisture. Not a little more, but a great deal more. All our systems of warming and ventilating provide for moistening the air. The difficulty with many of them, however, is that they do not provide enough moisture. The air rushes in so rapidly and is warmed so quickly that it does not take in the moisture it needs in the very short space of time it is in contact with the moistening surface.

Desert air which kills plants and animals is not as dry as that in a house where winter air is raised to seventy degrees Fahrenheit without any moisture supplied. Desert air is often at 30 per cent saturation. This makes it so hungry for water that it destroys life to get it. But the air in a house in winter which is raised to seventy degrees is sometimes at only 20 per cent of saturation. It is dry enough to take life from plants and to weaken animal and human beings so that they die unless relieved by walking out into the natural air outside the house.

This artificially warmed dry air attacks the mucous membranes and makes them give up moisture so rapidly by evaporation that they forget their natural occupation and use all their powers in the act of supplying the moisture required by the air. Every breath makes unnatural demands on the lining of the lungs, the bronchial tubes, the trachea, the mouth, and the nostrils.

Instead of secreting healthful mucous the membrane yields water until it breaks down with overwork along unnatural lines and the whole structure of the membrane is damaged. It tries to protect itself by throwing off a thick sort of mucous, which clogs on the surface and remains there.

Disease germs gather on this mucous. They thrive there. It is a good place for these filthy creatures to multiply. They possess the whole surface. The mucous membrane cannot scab over as an ordinary wound forms a scab for healing. It merely secretes thick, unhealthy mucous.

And so it happens that the good mucous membrane which nature designs to protect our lives from the foul air diseases turns traitor to the body and gives aid and comfort to its enemies. Instead of killing off disease germs it collects them and feeds them well. Instead of forming the walls to protect the citadel it forms a highway into its very gates and invites the enemies to throng inside by the million.

When a patient is suffering paralysis so the throat cannot throw off the thickening mucous, pneumonia almost always ensues. The germs of pneumonia go into our throats at every breath and are killed off by the juices from the membrane, or are washed down to the stomach where hydrochloric acid cuts them up. But when they are permitted to lodge there they multiply so rapidly that death from pneumonia is the common end of paralysis.

So we should breathe as much natural, outdoor air as possible, for it will help keep the mucous membrane well. It is then that the membrane will keep us from having any of the foul air diseases. When we breathe air that has been warmed, we should see that it is properly supplied with a great deal of moisture. Merely letting

the air pass over a pan of water will not answer. The hygrometer shows us that such air is far from right. It should be somewhere near 50 per cent of saturation.

A kettle on the stove or a steam jet thrown into the warm air is needed to save life. Do not be afraid of ruining your piano or furniture by moisture in cold weather. You can hardly supply enough moisture to do harm in winter. Moisture in furniture does its damage when the weather during the day is warm and at night somewhat cold. In cold weather we need a great deal more than most persons imagine. Even those who construct heating plants have much to learn.

In Europe there is less suffering from wrong air than in the United States because the air there is naturally more humid and buildings are not heated so intensely. But to show how much harm wrong air is doing in England and by way of technical information, I will quote at length from a recent work on School Hygiene by Robert A. Lyster, pp. 299 to 303, where he speaks of throat conditions:

I. Adenoids.

Adenoids are soft growths attached to the mucous membrane of the nasopharynx or the cavity at the back of the nose. They are unfortunately very common among all classes of children. Heredity plays some part as a predisposing cause, but the actual cause is unknown. Enlarged tonsils are often associated with this condition. They may commence to grow after an attack of measles or whooping cough, and a probable predisposing cause is mouth breathing, which is acquired by many children merely as a bad habit. At the age of fourteen they tend to disappear spontaneously, but in many cases they have been the cause of irreparable mischief by that time. Their effects are numerous and are best discussed separately.

(a) **Depression and discomfort**—A child suffering from adenoids is continually feeling depressed and uncomfortable.

(b) **Mouth breathing**—Owing to the obstruction of the nasopharynx, the child finds it difficult or impossible to breathe through the nose. The mouth is therefore always open, and this gives a dull and stupid appearance to the face, which gradually acquires a mask-like look that is incapable of expressing either joy or sorrow.

(c) **Dullness and stupidity**—Not only does the face look stupid and dull, but the mental condition quickly follows suit, and the child becomes backward and incapable of doing much mental work. Examples are common where such children have been regarded as mentally defective, but it is important to remember that their mental apparatus is quite normal in every respect except that the brain is clouded, as it were, by their complaint. The writer well remembers two extreme cases that were presented to him by their teachers as badly defective mentally. These children had each been at school about two years, and had not yet succeeded in learning the alphabet. Fortunately, it was possible to get these cases properly treated, and on their return to school they rapidly became normal children. It is very probable that large numbers of adenoid children are at the present time being "educated" at special centers for mentally defective children. Of course this is the result of inadequate medical supervision, and not only wastes public money, but also fails to educate at all a child who is capable of being educated in the ordinary way.

(d) **Fatigue**—Directly any mental work is attempted the child gets a headache and suffers from mental fatigue. This is due to the difficulty that there is in getting

away the waste products from the brain. Such children are constantly complaining of headache.

(e) **Dead speech**—Owing to the absence of resonance the speech acquires a characteristic dead quality, and there is difficulty with the letters **m** and **n**, **b** and **d** being substituted. Thus the child says "by" instead of "my," and "do" instead of "no."

(f) **Deafness**—In many cases the opening of the eustachian tube into the pharynx becomes blocked and deafness results.

(g) **Chest deformities**—The obstruction that prevents free and easy respiration causes extra strong action of the diaphragm in the effort to fill the chest. In young children this may result in serious deformity. The sternum is pushed out and often bent, while the lower and lateral parts of the chest are retracted, producing the condition known as "pigeon chest." If adenoids are present in a rickety child, a common combination, these effects are very pronounced. A long, narrow chest is produced and the child is predisposed to consumption.

If the obstruction begins at about the age of ten the forced respiratory efforts produce a barrel-shaped condition of the chest.

(h) **"Veiled look"**—The eyes of adenoid children often have a characteristic appearance that has been called the "veiled look." This is caused by the lower lid covering more of the eye than it normally does. The explanation is that connecting the muscle of the lower lid with the ring of muscle surrounding the mouth there are small muscular bands which, when the mouth is kept closed, hold the lower eyelid down. If the mouth is perpetually open, this tension is relaxed, and the lower lid creeps a little way up the eyeball.

The lot of the adenoid child is not a happy one. He

is looked upon as stupid and dull; is often punished for not doing mental work that he is quite incapable of performing; and is disliked, ridiculed, and avoided by the other children. If he survives till the age of fourteen he loses the adenoids, but they have so crippled his development that he usually falls an early and easy prey to consumption a few years later.

Treatment—Directly the condition is recognized, the parents should be urged to seek medical aid. By the removal of these growths many of the children rapidly become normal in every way, and the author can recall several instances of adenoid children, previously regarded as being mentally defective, rapidly becoming bright and alert and active after the removal of the growths. The earlier they are removed the better will be the result, because their presence hampers and hinders the proper development of the child. It is only by systematic physical examination of the scholars that the detection of early cases can be hoped for.

Probably much can be done to prevent the growth of adenoids by proper breathing exercises several times a day with the mouth closed. Children should be most definitely instructed to keep the mouth closed. By these means the membrane of the nose and pharynx is kept in a healthy condition.

It is very probable that mouth breathing, as a bad habit, is an important cause of adenoids by making the mucous membrane of those regions unhealthy. Systematic breathing exercises with the mouth closed, several times a day, in the open air or with widely open windows, would serve to keep the membrane healthy and check the tendency towards adenoids. Probably large numbers of adenoid children die of consumption during early adult life, and so by preventing the growth of adenoids, and by

their prompt removal when they do occur, the great number of deaths from consumption may possibly be decreased. Teachers should remember that if they can persuade the parents of such children to obtain treatment for them they will not only be doing a public service, but will also help in wholly changing the lives of these miserable little unfortunates.

II. Enlarged Tonsils.

Enlarged tonsils are often associated with adenoids, and in some cases are the direct result of mouth breathing. The condition can be easily recognized by inspection of the throat. In some schools an astonishingly large percentage of the children (as many as 30 or 40 per cent) show enlargement of the tonsils, and it is often an indication that the housing conditions of the locality are inferior. If the enlargement is considerable, similar results to those produced by adenoids may be brought about. Mouth breathing and deafness are particularly common accompaniments. Also such children are particularly liable to throat affections, diphtheria, ulcerated throat, quinsy, etc., and also rheumatic fever. Teachers should suggest to the parents that such children require medical attention.

III. Sore Throats.

A child suffering from sore throat should always be at once placed in a desk by itself, because the condition is probably infectious. It is most important to remember that such cases may be suffering from diphtheria, and may set up a severe epidemic in the school. The fact that the child is liable to sore throat is not any reason why the above rule should not be observed. During epidemics of diphtheria and scarlet fever all children suffering from sore throat should be sent home and should be reported to the medical officer.

Chills and colds—Children improperly clothed, and especially those who are shut up in overheated and badly ventilated rooms, are liable to chills and colds. These may develop in their turn into severe illness. Severe "cold in the head" appears to be a highly infectious disorder, and any child with obvious symptoms of such should be sent home.

Anaemia—A large proportion of town children (boys and girls) are suffering from a deficient vitality that appears to be caused mainly by a diminution of the number of red corpuscles in the blood. Such a condition constitutes one of the forms of anaemia. It is brought about by badly ventilated rooms, by improper food, by insufficient sleep and exercise in the open air. The crimson color of the lips diminishes in intensity and in the worse forms becomes pallid; the child becomes languid, drowsy, and disinclined for exertion, and is quickly fatigued; headaches and fainting attacks become common; the appetite diminishes and becomes morbid, indigestible messes being preferred to solid food, and occasionally a fondness for slate pencil, chalk, or coal is developed. Such children should receive medical attention, and all the teacher can do is to see that the rooms are well ventilated and that the child is excused part of the lessons and encouraged to take exercise in the open air.

CHAPTER IV.

More Abundant Life.

The juggernaut is a good thing. Most of the good things of the heathen are deprecated by us because they are outdoor people and do things directly while we are shut-ins and are more tortuous. The juggernaut is kindly, for it dispatches the babe instantly and there is but one pang for the child and few for the mother. She is not harried by the thought, if I had only managed a little differently I might have saved my child.

I wish we could have a juggernaut to kill off several hundred thousand children annually instead of killing them by inches as we now do the thing. Of course I should not wish it to destroy any that are to make out to live even though they but remain only twenty-five per cent alive and drag out a wretched existence.

It would be wicked to kill a child that can possibly be saved to suffer a quarter of a century or enjoy a living death for half a century. But if we must kill unnecessarily, let us do it expeditiously.

The crocodile method is merciful—The Egyptian mother who gives her baby to the crocodile is far more humane than the mother who permits the saurian of social custom to devour her child by depleting its forces, eating its spinal marrow, distorting its frame, or perverting its nature.

There are a million men doing business in America

who would be greatly benefited if they could be sewed up in a bag and sunk in the Bosporus or any other salt water where there is a current and plenty of depth to insure their not returning to trouble us as corpses. These have escaped slaughter in childhood but have been made miserable for life unnecessarily.

Some naturalists have wondered how the fever for mountain air takes certain men away from home to tramp and climb and hunger and sleep out afar from any house with tight walls. But they ought to consider that man was intended to live in the light, to breathe God's pure air, to resist his cold, snow, heat, storm, and natural vicissitudes.

We all know better; but we follow custom—Whoever has a modicum of sense knows that the doctors are right who tell the mother to let her well babe sleep out of doors —that our houses are all too completely warmed and too tight—that our school air, desks, books, rules, tasks, etc., are largely instruments of torture.

Some officials who had to put desks into a new school asked Dr. Woods Hutchinson what form of school desk is best for the health of the child.

"It really is not material which form of desk you select, provided you don't let the children sit in them."

Knowing such things, we go on doing as before. If we are raising poultry, however, we do the thing that will get eggs and broilers. The hens of the modern chicken farm are far better housed and treated than the wife of the chicken farmer. His children do not begin to get the intelligent treatment awarded his chickens.

If eggs are "results" and broilers are sound graduates, the big schools of America are exceedingly poor chicken farms.

The things we pretend to teach in school are not ef-

fectively taught. In spite of our professionally trained teaching force, our scientific methods, our regularity of attendance and program, we have to teach the same things over and over a thousand times to get them lodged in the minds of the children, and when we get them in there, they lie in such an unorganized, confused jumble that the lumber is practically useless.

I have tried the experiment of keeping a student out of the schoolroom a large part of the time to see whether he would fall behind. I had suspicions that if he were not in there much of the time, but running about on errands and being an officer of the school, he might retain some of the knowledge the class endeavors to gain.

I found that with many pupils, the more they are out of their room in healthful action—not studying—the higher their marks.

How insanity begins in some cases—A school man has business with a large number of cases of insanity in parents and children. He learns that God does not make a certain definite percentage of our people lunatic, but they become so.

"Your father," I said to a freak boy, "died in the asylum, I believe."

"Ya-as."

"Was it drink that destroyed his mind?"

"Naw. It was de heat. He worked in a boiler room."

"Does heat hurt you?"

"Ya-as. I can't stand it."

"Do you know when one of these spells is coming on?"

"Ya-as."

He had assaulted his teacher, destroyed property of other children, stirred up and participated in innumerable fights, failed to pass his examinations, and given us endless trouble.

"How would you like to be my errand boy and run out into the street on business when you like?"

"Gee!"

"Come to my office next time you feel disturbed. Tell your teacher I wish to see you at that time."

Here is a note I sent to a neighboring school principal two days later:

"Dear Mr. ——:

"This lad needed leg motion and internal aeration. Kindly put your initials on this and send it back here and I'll be under obligations. Yours affectionately,

Watt."

That note got him nearly a mile of pleasant travel. It saved the teacher that pain in the back of her neck. It avoided an interview with a distracted mother. It saved the boy a flogging. He learned more in school after he got back that day than he could have learned in an ordinary week of uninterrupted school effort. We kept up the practice till he was fourteen and went to work. It avoided insanity and helped his progress.

Insanity grows on those who live in hot, dry air, do exasperating work, and feel abused. I think I could drive any sane child into insanity if I had the heart for it. To do it I should simply make the school and home a little hotter, a little drier, a little more confining, and I should apply scolding and sarcasm. I should require a little more reasoning before the natural reasoning power develops, make the work a little more abstract, and pile it on as a religious duty.

That should deliver him to the asylum.

We are doing enough of this now to deliver a good lot of the population there. Of course, whiskey and excesses are frequently called the causes. But the principal evil which drives to drink or other excess or prevents girls

from developing normally is the unnatural air in the school and home.

What outdoor work does for the tuberculous—In the summer of 1909 we made a demonstration of what fresh air and proper feeding will do for children predisposed to consumption. In the month of August, the month when the heat was so intense as to shrink the government's estimate of the corn crop 385,000,000 bushels, we put an average of four pounds on the frame of each child in attendance, including some who were not regular in attendance.

At the same time we found the children brightening up mentally and we gave them more instruction in five weeks than is usually given a class in school—well pupils—in six months. We did not do this by skillful teaching, but by getting them to desire to find out things and then permitting them to learn.

These were sick children. But we made them stronger and more intelligent. They went back into the regular schools and began to succeed there.

Tubercular children are not bright, as a rule. They are not only dull and lacking in interest, but they are ugly and resentful. You cannot improve them by any form of punishment What you do to correct them is received sullenly with the idea that it is merely another instance of the oppression of the helpless that goes on everywhere. They are not bright enough to profit by any form of punishment.

So we found that such sick children are to be saved only by kindness, fresh air, right food, and the stimulus of a gentle exercise of faith in their increasing powers. By telling them to look for new mental ability in themselves along with their physical improvement, we got them to co-operate with us in bettering their minds and morals.

Why not try it on the well?—When we had done so much good to sick children by means of fresh air and kindness, it weighed heavily on me that the well child is entitled to just as much. It seemed also that the sick child, not tubercularly inclined, ought to have equally sane care.

We are doing great things now to stamp out the white plague. But there are other diseases equally preventable, equally deadly, equally responsive to the same treatment.

So we are giving fresh air to the well—We opened two first grade rooms last September specially for the children of those who believed in open air work. We opened, at the same time two first grade rooms of the ordinary sort. We gave the parents their choice. No heat was given those rooms until late December brought us zero weather. Windows were kept open. All seats were removed to give large floor space for games. The children were told to wear their street clothes if they chose, but to lay them aside if they felt inclined.

Teachers forbidden to teach—The teachers were told that this demonstration was to be different from ordinary school in that no formal teaching should be done. An entirely new method of learning to read was inaugurated in which there is no study, no failure, no conscious effort, and no instruction—but that is another story.

If any child could find out anything and learn without teaching he need not be punished for doing it. But instruction is not the business of those rooms.

Of course, the children are learning faster than any others. They come to school with a consuming desire to learn to read. The activity and atmosphere of the room increase the desire and the alertness. We cannot help letting them learn. But we do not teach them!

The business of those rooms is to fit the children—The teachers are asked to fit these pupils physically. It is recognized that the great business of the school ought to be to make children strong, good, and wise. The schools which follow the customs of today do not accomplish this great work. Some children are wise, or good, or strong, in spite of the schools, but rarely because of them. It is very, very rare that any one child acquires these three attributes—wisdom, righteousness, and physical and mental strength, but those who have observed children in open air schools or in humidified rooms of low temperature believe they are far more likely to secure these great qualities than they would be if confined in warm and excessively dry quarters.

The missionary effects of the two open-air rooms in bringing a community to see the advantages of right atmosphere are noteworthy. More parents have been induced to open their bedrooms by what little children have said to them than could have been brought to the light in any other way. The idea of permitting their children to study in a cold room aroused them keenly. Some parents were eager for it as soon as they heard the arguments for it. Others preferred the warm rooms for their children. All were stirred up. There was much talk. The judgment of the principal and teachers was talked over. The desire of the little children to be transferred to the open rooms put parents into doubt and led them to seek information.

Then older children took up the question. That children are really sufferers in the ordinary school is clearly demonstrated by the actions of those who are enrolled in a warm room but have visited a cold one. Teachers in other grades looked with suspicion or doubt on the plan when first made known to them. Almost unanimously they said the children would doubtless learn more and be

happier and stronger if they could stand the cold, but they were sure no ordinary teacher with the tendencies to catarrh, rheumatism, neuralgia, and other troubles which pertain to teaching in a warm room, could possibly endure the cold.

But while they were reasoning that a new kind of teacher must be found for a cold-air room, some of them began suspecting that the cold air might possibly make new persons of themselves. They asked questions. They visited the open rooms. They thought much about it. Then, one after another, they inquired whether they could try it awhile and return to the old way if they came to grief.

No teacher was asked to take a cold room. No pupil was asked to enter one. But we have found it expedient to open room after room to the cold air plan, and at this writing it appears that twenty out of thirty rooms are to begin the next school year with windows kept open, but with the provision that when severe weather comes, those teachers who desire heat in their rooms may have it.

This will make the rooms of the school one-third warm and two-thirds cold. Pupils and teachers are to have their choice. Perhaps we shall be embarrassed at not finding enough advocates of warm air among the children to fill the ten warm rooms. The office is to be cold, but the library warm. They are beside the main entrance. The main business of the school will be done in cold air. How long this will be kept up remains to be seen. But the spring months find many of us looking longingly back to the severe winter that has passed and forward with great expectations to the winter that is to come.

We expect to make the school a place to build up in. We do not expect the physicians near us to have such a prosperous year. These generous individuals are com-

mending us on every hand although they see in our work a diminution in theirs.

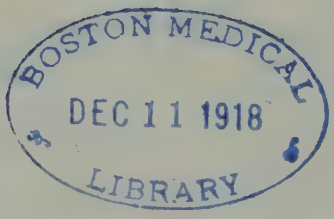
But we confidently believe that a great deal of fatal slow torture has been ended in our midst. The fact that we can find not one pupil or teacher who has suffered from work in the cold and many have been benefited remarkably by it, encourages us to proceed cautiously but hopefully.

Fresh air is demanded by Luther Burbank—"To develop indoors, under glass, a race of men and women of the type that I believe is coming out of all this marvelous mingling of races in the United States, is immeasurably absurd. There must be sunlight, but even more is needed—fresh, pure air. The injury wrought today to the race by keeping too young children indoors at school is beyond the power of anyone to estimate. The air they breathe, even under the best sanitary regulations, is far too impure for their lungs. Often it is positively poisonous—a slow poison which never makes itself fully manifest until the child is a wreck. Keep the child outdoors and away from books and study. Much you can teach him, much he will teach himself all gently, without knowing it, of nature and nature's God, just as the child is taught to walk or run or play; but education in the academic sense, shun as you would the plague.

"Not only would I have the child reared for the first ten years of its life in the open, in close touch with nature, a barefoot boy with all that implies for physical stamina, but should have him reared in love.

"If you have the first ten years of a boy's or a girl's life in which to make them strong and sturdy with normal nerves, splendid digestion, and unimpaired lungs, you have a healthy animal, ready for the heavier burdens of study. Preserve beyond all else as the priceless portion of a child

the integrity of the nervous system. Upon this depends their success in life."



CHAPTER V.

What Right Air Will Do for School Attendance.

Pupils drop out of school for many reasons, but the chief one has not been emphasized. They drop out mainly because they are not well enough to stand the strain, or they are made so dull by the air of the schoolroom that they acquire a distaste for books and are glad to get out where the air is right and they have a chance to do the work of a man or a woman in the world instead of sitting in a place where there is very little accomplished but a great pretense of trying to do things goes forward.

President H. J. Waters, of the Kansas Agricultural College, in his inaugural address said:

"Of the eighteen million children in the graded schools in the United States today, less than a million, or less than one in twenty, will ever matriculate in a high school or academy. Moreover, of the nine hundred thousand pupils in the secondary schools, only about two hundred thousand will be enrolled in our colleges and universities, or approximately one out of every four. It requires, therefore, approximately eighty pupils in the grades to supply one college or university student. Less than one in five of these college and university matriculates graduates. Therefore, over four hundred graded school pupils are required to furnish one college graduate. Of more significance than all this is the fact that seven out of

every eight of the boys and girls of the United States leave school between the fifth and sixth grades and go out into the world of splendid opportunities without the training and intellectual power to enable them to take advantage of these opportunities."

He complains that the courses do not fit the needs of the children. But the real reason is not that the courses do not fit the children but that the air is not fit for the children to breathe. A muskrat may come to the surface to breathe, but the child who asks too frequently to go out is put on the black list in the teacher's estimation. In a place where the air is wrong the brain will not work right. The child finds out he is not succeeding. He does not know the reason, but he suspects it is because he is born short in certain essentials and so he gladly accepts the first opening for escape from the thing he does not wish to do and does not think he has the ability to do, merely because he has never had a chance to try to do it under favorable conditions.

Give a school right air and the pupils will accomplish the work of any course that any enthusiastic college man ever devised for poor little children. They can do it. I do not say it would be wise to let them do it. But the ability of well children who have plenty of oxygen at command and in a temperature which permits the mind to work normally, will acquire any set of results any overzealous superintendent ever got out.

"Oh, they can do it!" is an expression often heard in educational discussions. Perhaps here is the place to speak of that. When there is doubt expressed as to the wisdom of putting in note reading in second grade music, or certain technical difficulties in art or mathematics, or any other subject in any grade, the common answer is

that the children can readily do that for it has already been done in certain schools.

Because a child can do a thing is no reason at all why he should do it.

I have known a boy to walk a tight rope across a rocky ravine and receive no harm. Another tickled the hind heel of a mule and got away alive. Another spent hours every day in a school basement and resisted the microbes collected there. Another knew all the multiplication table to 24 times 24 at the age of twelve. Another could sing the chromatic scale. But that is no reason at all why other boys should even try to sing the chromatic scale. It is no reason why those very boys should ever again go through with the performances mentioned. I do not wish to see a boy continue to tickle the mule or to sing the chromatic scale. One is seriously hazardous to life and the other to musical art.

We have laws preventing cruelty to animals in the matter of overloading, and we do not permit a driver to plead in court that the horse once drew just such a load and is yet alive. How much more should we have laws preventing the overloading of children who have the serious business of growing to attend to! The horse was fully grown. No farmer is foolish enough to work a colt hard. But there are men who say they want their sons to buckle down to good hard work while they are young and have the nonsense taken out of them before it spoils them.

Because German boys sit several hours longer in their schools than our boys are able to stay in our schools it is not reasonable to say that our boys should be put under the German schedule. It would be well to consider what happens to the young Germans who come over here and enter our schools. It might be enlightening

to see what happens to the American boy who chances to reside for awhile in Germany and goes into such schools.

Right air lengthens one's capacity for work and for continuing at a given task. If our schoolrooms were of the same temperature and humidity as are the schools of Europe we might let our children remain in them longer hours. But under present conditions we may almost say that the fewer hours our children spend in the schools in the condition they are now in with respect to air, the better for the children. In fact those who have the best right to speak on the matter are positive that no child should attend the kind of schools we have until after the tenth year. But while we know how dangerous it is to send little children to our drying kilns for culture, we keep right on doing it. Perhaps, however, this is merely another example of what happens to the mind which has suffered the tortures of indoor life in dry, hot air, it is keen to suffer, but it is within a body too weak to do anything about it except to grumble.

Our country throngs with nervous wrecks. As we progress in wealth and culture the thing becomes more prevalent. Men are breaking down in business by too much attention to it they think. The real trouble is, they are conducting their business in hot, dry rooms during the cold months of the year. There they become so weakened that the right air of the warm months does not revive them. They chase after health in the summer at first and then at all times in the year . But they still persist in keeping the temperature of their apartments hot in cold weather, and the apartments are all constructed so they are viciously dry, and the patient gets no relief by night or by day in summer or in winter, and he mourns his approaching departure from this sphere

of activity as one who approaches his grave soothed by having fought nobly for what was worth fighting for. His family speak of him as a great sufferer, too ambitious to do well by his family. His friends lament that he kept his nose upon the grindstone too continuously and wore himself out with application to details.

The truth of the matter is, the man simply lived in air that was vile. He tried to work in it, but could not endure the strain. Wherever he went for relief in cold weather the conditions were the same and his lungs were deprived of the thing which would make them do his body a real service. Wherever he went in summer the air was too mild to stimulate him and send his blood tingling with pleasurable thrill to the tips of his fingers. The poor man died really of suffocation. He gave up the ghost for want of breath.

Had he dreamed that he was denying himself life daily, weakening himself beyond the power of recall, he might have found a remedy. But being deceived as to the cause of his debility, he went to his death with a grim determination to die game.

Let us tell men that they do not need to break down with the work that can be done in reasonable hours. If they will but provide right air instead of that which they find in their offices, their shops, their hotels, restaurants, homes, schools, churches, and everywhere except outdoors, will double their capacity at least. They may cut off headaches, irritations, and a multitude of things which cause them poignant suffering daily in the bad air under which they endure the strain. Most of us who are under sixty years of age can do all our business in an office with the windows wide open and very little if any heat supplied during the worst winter. We are not as young as the children and not as active, but we

may reasonably take time enough from our work to warm up a bit with a little sharp exercise right in the hours of business.

I do not expect this advice to be followed immediately by many persons, but I wish to make it known that I kept my own office pretty close to sixty degrees, many times under it, during the cold of last winter and I am planning to have it as cold as outdoors next winter.

My reason for this is that I have found my own capacity and happiness have been much enhanced by the air I have enjoyed while there was cold air to be had, and I want all I can get of that cold air, day and night, from now until I am released from working for the good of the public.

If we find it good to sleep in zero air with plenty of blankets and good shelter, why is it not also good to do our work in it with plenty of clothing and a chance to exercise occasionally.

Does the teamster who sits on a high seat during the winter blast suffer more than man ought to suffer? I think not. He really suffers less than the man who sits at his desk in a hot, dry room and wonders how the Lord ever made a man tough enough to do the teamster's work.

The Lord will make that very man, that timid fellow who sits in the heat all day—will make him as hardy as a teamster if he will take the air the teamster gets. Properly clad, the teamster, without much exercise, is able to sit out in the blast with pretty good comfort, provided he does not go in too frequently somewhere to warm himself or to take something to increase his bodily heat.

If we give our children a chance to get the good air the teamster gets, more of them will be able to stay in

school so as to graduate. Many of them who now drop out will get through high school. And our universities and colleges would be thronged to overflowing with successful students instead of the kind they now have, if they but knew how to supply them with right air and the students were supplied with such air while preparing for their higher courses.

It would pay the colleges to give up their endowments for a year or two and go into a right air campaign, for they would find the increase in enrollments far exceeding any increases they have been able to secure by any advertising methods they have ever devised.

Let us make our schools tolerable. Let us have them such that they will foster health rather than breaking down. Let us give pupils a habit of succeeding instead of doing as we now do, making nearly every pupil think himself a numskull.

Let us increase the capacities of our pupils by giving them the air which will permit them to remember what they have previously learned. Let us give them the air and exercise which will make it easy for them to learn. We may as well save seventy per cent of all our labor and that of our pupils by brightening up the pupils and their teachers with right air.

Then we shall find there will be a great increase not only in the numbers of those going through the grammar schools, through the high schools, and the colleges, but there will be a great increase in the efficiency of those who are in the classes in these institutions.

CHAPTER VI.

Learning to Read in Open Air.

Our fresh air rooms were not devised for sick children. We have an idea that the child who is perfectly well is as truly entitled to sanitary and sane treatment when he is young and sound as is the child who has been ruined by his surroundings. We think he has a right to these healthful conditions as surely as the child of tuberculous parents is entitled to the open air school for consumptives.

We opened the fresh air rooms for the purpose of getting children fit to study. I was dared to do this by my fellow educators in a meeting where we had considered the subject of reading and found that recent science is against the methods commonly used. After some statements had been made as to how teaching should proceed in the primary reading class, I said there are many things in the way of reasonable teaching, and if I had my way entirely I should have a very different school from the ordinary.

"Why do you not show us the kind of school that ought to be?" asked several.

"Because I am under rules in a system where loyalty is supposed to be a virtue. If I should begin to conduct the Graham school as I believe it ought to be run, I should take out all the desks in the low primary rooms and substitute simpler furniture, I should take out

ENTHUSIASM SHOULD ACCOMPANY INDUSTRY.

CITY CHILDREN ACQUIRING VITALITY.

some of the windows or throw them open wide, I should cut off the ventilation system so as to deliver little or no heat in the rooms so opened, I should entirely disregard the course of study as laid down by the board of education, I should train my teachers to do less teaching and put in most of the time in training for health, I should get my engineer fined for violating rules, my teachers reprimanded for insubordination, and I myself should be called before the management committee and dismissed from my position for incompetency."

"We wish to see this tried."

"Now I think of it, I should like to lose my position in just this way."

On the request of the principals of the district the district superintendent gave me carte blanche to do as I believed best in my low grades and make a demonstration of what fresh air, right psychology, and a more humane procedure will do for a class.

Reading was the subject of the meeting, and I may as well give here the substance of the discussion.

We do not see all the letters in a line of printed matter. Teaching is usually conducted with a view to making the child see everything that is put before him. He is considered culpable if he neglects to see every minute thing in connection with any subject taught. He has been made to visualize words, not only to know them later but also to know how to spell them.

But the adult who reads does not see all that is in the line. He does not even see the letters of the shortest word. He glances in the most cursory manner possible over the whole line and takes in its general shape. He thinks of what he is reading and knows pretty well what to expect. He estimates that the writer says a certain thing, and usually he estimates rightly.

But the eye does not run along the line and take it in as a whole. It makes from three to seven quick jumps to the line. This has been found out by photographic tests and the surprising thing is that the eye sees very little of what is in the line, merely focusing itself on these few spots, and the mind does the rest.

When the mind guesses wrong the eye goes over the line to see where it jumped the track of the author's ideas and went to putting in ideas of its own. At the point of departure, or error, it takes up the same process of guessing again, and the reading goes forward as a process of supposing or estimating that the writer says certain things which come readily into the mind of the reader.

In fact, there are skillful readers who do not even look at the lines. They go over the whole page and take in at a glance about all there is of interest on the page. The reader often is seen to stroke his hand over the page and leaf the book over as if looking for something he has lost.

I might name to you a number of great men who read in this manner. Can you imagine Mr. Roosevelt as looking at the letters on a page? Can you picture to yourself a clever woman who reads current literature as going over each line of the story with patience, observing all the letters and the punctuation? Such readers are far too eager to get on to something that is coming. They do not care whether the present page is perfectly read or not. They get the main ideas of the writer and they guess at the others. Ninety-nine times out of a hundred they guess right.

Look at the ordinary literature and see how often you can cover up a lot of it in advance of your eye and tell exactly what is under your hand. Do you suppose a man or woman of brains is going through the tedious

process of looking at all the letters when there is not the slightest interest attached to them? It is the ideas one reads to get, not the sequence of the characters on the pages.

And so ordinary reading by an intelligent mind is not reading at all as taught in school. And it is ordinary reading that the pupil wishes to learn to do. So we are teaching our pupils in the ordinary school the very thing they will have to unlearn when they become adults, or before that time. We are telling them they must observe everything on the page. We take them to task if they fail to see every minute thing. We forget that they will eventually read to get the ideas or to pass them to others, and they can do neither if they give close attention to the print.

Now is it possible to teach a child to read like an adult at the very outset in school? This is what we are doing. The way to do it takes but little explaining, but is quite open to objection if you read it as a pupil of the old sort instead of reading it like a man.

The child comes to us full of an intense desire to learn to read. The ordinary school receives him in this attitude. He thinks he can learn to read in a few days if he puts his mind right down to the task. We know we can teach him to read if he can hold out in his desire and will work for many hours at a very wearisome task. But we know that years of agony are ofter too few to make readers out of many children who have once had this strong desire, but the desire fades away under the difficulties encountered in the ordinary school.

When he finds out that it takes years to learn to read and that nobody in his class can read very well and no one of his acquaintance except adults can get much out of the page, he begins to lose his ambition, and many

times falls out with learning entirely and it becomes the merest drudgery, the child submitting to it because he must and the teacher following the routine because she knows nothing better.

"Line upon line, and precept upon precept" is the old maxim, and in learning to read by the methods in vogue, it is an immense task. It is almost too much for any child, and if he were not corralled by the year and made to labor over the matter for hours daily, it is likely that he would give up and become illiterate unless by accident he found out how to read by use of the ideas and taught himself in a little time without a teacher.

In our plan the child reads perfectly the first time he tries it. It is the easiest thing in the world. He is charmed with his ability. He is perfectly enthused with success. The teacher does not have to tell him anything. He knows it all at once. Proceeding with this good conceit of himself he comes to the place where his mind has to act in recognition of what it has grasped before, but the act is such a natural one that the child does not recognize it as a task or anything at all difficult. The memory acts like lightning and the memory is strengthened by its success instead of being jaded by failure as in the ordinary methods.

The teacher is instructed not to teach the little chap to read. She is merely to let him have a chance to read some time when he is sure to do it right and when he intensely wishes to read. She finds out what nursery rhymes he knows by heart. There is usually quite a number of them. She has some of these printed in a book which he is to use. She has them also printed large, not in script, on a chart.

She looks at the book and reads, "Jack and Jill went up the hill." She does not dally over the words, but goes

right on with the story till the disaster has been told. Of course, every child in the class knows the whole story. It is such a good story that all would enjoy hearing it if there were no other motive. But the main thing is this throbbing desire to learn to read which the class possesses to a man. They can see the lines of print. They know what they mean. They look vaguely at the lines and read the whole story. They do not see the letters. We do not wish them to see the letters. We wish them to see Jack and Jill and watch the ridiculous performance. Their minds are fixed on the action of the piece and also on the strange thing of looking at the book which tells the story and saying the words off in order, not quite realizing that the printed words in their regular order tell the story in its regular order.

They play at reading—That is the secret. They make believe read just as they make believe keep house with their dolls. When they have read the story in concert and individually the books are put away and something is done to permit them to forget as much as possible of what they may have happened to learn. They have not used the books so as to fatigue them in any way. When their eyes have gone over the page there has been no weariness, but there has been a live keenness that passes understanding.

The next reading lesson is just like the first, a mere play at reading. It is looked upon as a joke, but a very important and profitable joke. Every child in the class can read that piece perfectly. He has his turn at it and enjoys it more than tongue can tell. Then the chart is shown with the same story on it. The teacher looks intently at the chart and reads it. So does each child. And then they do something else. Most of the time is spent in doing something else.

We consider the little people are not there to learn to read or to try to remember. They are there to read and to remember without learning or trying.

Who ever heard of reviewing a child on the names of his playmates for fear he might forget a name when he wished to call it out! We do not review the names of the classmates and we do not review the words or sentences. We review nothing. We expect, however, that a mysterious power will come to the aid of a properly taught child and he will remember everything worth while at the instant of his desiring to remember it, without any conscious effort.

Trying to remember is very hard—Remembering is very easy.

Just try for yourself. Think of something you have forgotten and see how hard it is to remember it. I am not speaking Irish to you when I ask you to think of something you have forgotten, for if you have been in school regularly you have been practicing that sort of thing all your life and you have a memory that is far from perfect. You have been trained to forget and to take things in in a hazy way. Of course you can recall the thing you have not forgotten. But if you know it well you have difficulty in getting it clearly into mind when you really wish to use it. So you say, "I know that just as well as I know my own name. I'll think of it in a minute. Strange it has slipped from me just as I had it on my tongue."

There is nothing strange about it. You have been trained to forget everything by taking everything into your mind in the very way that makes it slippery in time of need. If you had only been trained to take things in positively, with avidity, with delight, and intelligently, instead of mechanically and with expectation of losing

them, you might have a memory. But your schooling spoiled your mind. That is one reason why the man who never went to school and never learned anything he did not wish to know can discount you in anything he undertakes. What he takes into his mind goes in with a snap. It means something right then and it is a possession instantly.

The dull plodder has been commended in all schools because it is said he can retain what he learns while the quick student forgets easily. That is a falsehood. The one who can take in ideas at a snap and does not need to review them at all is the only one who is really learning much. By baking children in dry, hot air and keeping them inactive all day long we get them into a state of indifference and incompetence which is truly alarming. By expecting them to forget everything we tell them and making them review continually we train them for beggary of intelligence.

So all the reading done in our open-air first grade rooms is play reading, but it is all accurate. It is by lightning activity of the mind that the words come to be recognized without study. The child hardly knows when he has learned anything, but before he has played reading long he knows more words by sight than the child who has been making hard work of trying to remember things which are very unnatural to remember and cudgelling his brain to make it do by hard work what it might do with perfect ease and certainty.

Does he learn to spell? Positively not in the first year. Does he learn phonics so as to build new words from the letters as is done in all standard schools? By no means. He merely knows sentences at sight and makes enough synthesis to know words by themselves; but we make no effort to teach him to spell, and we give

him no phonics except enough to know what the initial sound of a word is so he may be a better guesser when he comes to a new word which he really wishes to find out for himself.

Does he learn script? Yes. He learns both to read and write it. But that comes incidentally. He suddenly finds he can read script because script words resemble printed words much more than script letters resemble printed letters. It was not our intention to teach script in the first year, but accidentally the district superintendent got enthusiastic over a class one day and tried them on script, not realizing that we had never let them see script. They read it to her easily and quickly. After that accident we had script as another activity of the school but not as a subject for study.

And so we have an abundance of time to get the children fit physically and mentally for school work, but we do none of that work in the first grade. The ability developed shows that we are doing what gets the results. But these are got indirectly and by accident rather than by design. When the children have spent their ten months in the grade they will know all that can be expected of children of their years. The class will average up ahead of the ordinary class in reading, while in general intelligence, health, vitality, aliveness to all kinds of situations, and resistance to disease and fatigue, they will be so far ahead that it will be a wonder if we can get any pupils to open a warm air room in the school next September. All will ask for the cold air rooms, and we shall have to make all our first grade rooms of this kind; although I expect when the weather gets rough in winter we shall close one of them and gather into it those whose parents are afraid of physical results. For it will be years before mothers will find out that catch-

ing cold is really not the result of being in a cold place but of being too warm somewhere for a time.

CHAPTER VII.

Vitality and Eagerness to Learn.

We open the windows of certain rooms in the Graham school for the purpose of giving the children an experience with the air as nature sends it. This treatment is not for the tuberculous or any other special class. It is for all whose parents approve. We have other rooms of the same grades for the children of parents who do not ask for fresh air. Every pupil in the fresh air rooms is there because he wishes to be there and his parents have consented.

We vary the temperature—In the fall we did not use any heat except that supplied by the vigorous bodies of the children in their games and exercises. As winter approached we continued using no heat until the zero weather came. Then we opened the warm air ducts and treated the school to a modification of the outdoor temperature, but we kept the windows open to some extent at all times.

After the coddling of the holiday season it was not safe to give the children as low a temperature as we trained them to take in the fall. So we began with a temperature of 50 and gradually decreased it to 40. Now in cold weather we give them 50 on Monday mornings and run it down during the day and during the week, not going below 40, but keeping large openings at win-

dows to insure the proper amount of fresh air and the right degree of humidity.

What does it do? It gives vitality. It increases mentality. It promotes happiness. It gives a good appetite for common food. It gives the child a zest for the things of culture. He wishes to learn the things of school. Not with that mild desire which the ordinary pupil manifests when he knows the manifestation of it will please someone. But with a fervor of spirit that would do your heart good and make a teacher think she had dropped into some sphere where children are what they ought to be instead of what she usually finds in school.

Are we teaching the children in these rooms? Not in the kindergarten and first grade. Not as the word teaching is usually understood. These rooms are not rooms for teaching. They are rooms for humane treatment of children who wish to learn. They are permitted to learn in these rooms, but they are not given the usual routine. They do not spend anything like the amount of time in reading that is consumed by the ordinary class and is contemplated in the course of study and regular program of a school.

The teachers in first grade are positively instructed not to teach. They are told that the children are there to be fitted to desire to learn. They are to be made teachable, but they are not to be taught in first grade.

Do the children learn anything?—Yes; they are of the sort that will learn in spite of you. They find out things of their own initiative. They scan their books with avidity, but not because they are asked to do so. They grasp ideas in a wholesale and wholesome manner which is a delight to the beholder. But they are not taught.

After the first three months with these beginners their teachers told me with some surprise that they would have

to promote some of them before the end of the term of four months, for they had done a year's work already.

I said, "No, ladies; we must not promote one of those little ones. They are in there for a year and they are not going to see second grade work merely because they have happened to find out all about first grade. You agreed not to teach these children when you took them, and we must not spoil this experiment and the children by pushing them at the age of six into the room where the age ought to be seven, but often is eight or more. We are not going to punish them for finding out these things."

"But what shall we do?"

"Trust in the Lord and keep working with those children to fit them to learn by-and-by."

We want them to be well, strong, and keen in their interest. We do not wish them ever to find a hard thing in school. Not because we are going to make things easy for them, but because we are going to make them the kind of girls and boys who can do all the things of school easily.

No child is to participate in any exercise which he does not relish. If he does not feel like doing the thing that is a sign that he ought not to do it. If the teacher does not wish to give any particular exercise at any time, she must not give it. If she is weary at any time, we have a place where she may go and lie down, but we are determined not to permit her to remain and try to direct those little people when she ought to be in bed.

This last is unnecessary, for there has not been a day when any fresh air teacher has been fatigued by her work. All of these teachers know the weariness of the ordinary school, but you cannot catch them looking tired or feeling lack of interest now.

How can the children keep from catching their death

in there? They keep well because they have the vitality to resist disease. Are they all well—entirely? By no means. Some of them are subject to the various ills of childhood, especially childhood without a selected parenthood. But they get vigor the first day. A week makes a difference in their appearance. They are able to resist the attacks of disease to which the ordinary child succumbs.

We have been burying too many children—It is better to put them under conditions conducive to life and let them grow up. The undertaker sells far too many little coffins. He would make a better profit, though deferred, if he could wait and sell his coffins on an average two feet longer.

How do we know this? Because we see disease disappear before this treatment, we see strength, appetite, clearness of vision, alertness of mind and body, all produced right here in these open air rooms.

After eight weeks of life in two fresh air rooms our physician inspected the pupils specially for evidences of catarrh in the head. Among the ninety pupils he found two who had nasal discharge. Looking into the next two rooms where the ordinary air of the school was being breathed, he found forty children with nasal catarrh.

Then we went after the two culprits who brought nasal discharge into our fresh air rooms to find what was wrong with them, and we discovered that they had not been regular in attendance. They had coddled themselves at home and then returned to us with catarrh ready to infect every other child in the room.

Did they spread the infection? Not at all. Their schoolmates would not accept it. They have the vitality to throw off foul air diseases, and they refused to catch

the cold in the head which they might have taken readily had not their resistance been well up.

Our one bad result is interesting—A mother came to me troubled because her little daughter had a bad cold in the head which they could do nothing with. My first question was, How does she sleep? With the window open enough to give good change of air. She sleeps in a separate bed in the large room with her father and mother. In severe weather the window in that room is not used, but the window in an adjoining room is open. Knowing the ordinary child will be free from trouble under those conditions I looked elsewhere.

"What sort of underwear has she?"

"The best of wool."

"Perhaps that is the trouble. Does she perspire freely?"

"Always, on the slightest exercise."

"That may be the cause. Possibly she ought not to wear woolen underwear."

We went to the classroom and observed the child. The temperature was at 43. Most of the children had their wraps on as if they had just made ready to go out upon the street. The little daughter in question sat bundled up as if for a sleighride. I called her to me and found her neck moist and warm. Putting my finger down her back I found the thickness of clothing nearly one inch.

No wonder she perspired freely. It was about the only thing she could do with so much bundled about her. We removed her heavy coat and left her with her sweater and other clothing still on. She felt better, of course, and when she found there was nothing to fear from taking the coat off, she joined in the exercises of the school with

much greater freedom and thereafter wore much less clothing.

A little seatmate had short sleeves and bare arms. I took hold of her wrist to see how her circulation was overcoming the temperature and found it warm and natural. "I'm not cold," she said abruptly, fearing I was going to ask her to put on her coat. The mother knew her and exclaimed that she is always well and her daughter catches cold. "But how can she keep warm with so little on?"

"Easily. Put less on your own child and you will soon see. But begin moderately."

We do not permit the children to sit still for any length of time in the fresh air rooms, especially in cold weather. We imitate the motions of various animals, birds, and moving things. We fly, swim, run, jump, stamp, shout, sing, wrestle, and have a jolly time. There is a great abundance of things to do without getting into the educational line. Doing these things, children and teachers are warm and happy. Incidentally there is a great deal of learning done in those rooms, but no direct teaching.

Pupils in higher grades saw what gains were made by their younger brothers and sisters and began to petition for fresh air rooms of other grades. As we found it practicable we opened other rooms so that the higher grade pupils might be benefited. At first it was thought that the program could not be carried out owing to the fact that the cold weather requires much bodily activity for comfort and we could not get this without infringing on the time of the program. But we soon learned that an hour spent in study under ordinary circumstances is not worth so much as forty minutes spent in study

with two ten-minute periods of bodily activity separating the work.

This gave us a new idea of the value of the activities of the fresh air rooms, and we have simply taken from the program as much time as was necessary to get the right amount of exercise for warmth and enjoyment and have divided the remaining time in proportion as the whole time was divided before, keeping the same percentage of time for the different branches.

All educational work has been mechanically divided into time limits, and educators have rather unconsciously, I fancy, grown into the habit of worshiping the program and thinking it one of the most important things in the world. All our high school work and that in the colleges and universities is divided into term hours and students get credits for spending so many hours in recitation or in the laboratory in a given subject.

Now it is well known to every observer that there is a vast difference between the work done in an hour by two different students, or by the same student under different conditions. But because we think we have to measure the results of our work to reward the diligent and punish the lazy, we have fallen into the habit of measuring work by the clock, a very ineffectual method indeed and one calculated to work considerable injustice, as every student in high school or college well knows; for it often happens that students who do no work at all, or at least a very little in the most superficial manner, come out at the end of the semester with creditable marks, while others who have really worked well and been somewhat irregular in answering to roll call are required to do the work over again.

Because the schools cannot measure their product they are not content to pursue the method of the farmer

and wait for the crop to ripen, they must dig up the plant every little while to see whether it is growing satisfactorily, and when the wheat has been in the ground a certain number of days they count that as such a per cent of the whole crop of finished wheat.

Now that we have seen pupils work in fresh air we find that they are able to do twice as good work in the warm, dry air of the ordinary school. Seeing the work is so effectual it is best to accept it for what it is really worth instead of judging it by the old standards of so many minutes a week. Perhaps we may satisfy the sticklers for the old order of things by reckoning ten minutes of fresh air work as equal to twenty minutes of work in warm air. With this mode of reckoning we shall be able to give the proper number of minutes a week to each study by cutting the required number in two and using the other half of the time to intensify the work by putting the bodies of the children into condition to afford brilliant mind action. If we should be more conservative and say that ten minutes of work in fresh air is equal to fifteen minutes in warm air, we might cut the program into thirds and use one-third for bodily activity and two-thirds for study and recitation.

But we have found it unnecessary to make any such divisions. We occupy the day in the higher grades with the subjects of the course of study and the games and exercises which make the study of the course effectual. We try to give each subject its due proportion of the whole time of the day, but we do not consider that the running over of time in a certain direction and correcting it tomorrow is any loss to the child or to the school as a whole. We divide the time in the proportion indicated in the time program in the course of study and then get a great amount of time for those things which are not

study or recitation but which make study and recitation worth much more. We count the time taken in fitting the mind for mathematics as spent on mathematics.

We reason it in this manner: If a certain lesson must be studied over twenty times to fix it in the child's mind, there is no harm in asking him to study it over ten times and then between times putting in some work which will make the ten times worth more than the former twenty times. Nobody is cheated when we get ahead of a dull routine in this manner. It does rub hard on the consciences of teachers who have worked long at the old method, but they are able to accustom themselves to it after a few weeks of experience, especially when they note how much better the work is, how much more intelligent the class seems, and how an air of superiority and confidence in their own powers takes hold of the pupils.

At this writing we have plans for open air work in all grades, but we have not yet put them into regular practice above the fourth grade. Our eighth grade pupils have a strong desire for open air work, and if next fall we find ourselves able to establish cold air rooms for all the grades of an elementary school I am sure the experiment will be watched with a great deal of interest by all educators, especially by those who are actually engaged in the work and who will be the only ones fully capable of making a just estimate of the advantages and disadvantages of cold air work for pupils in the grammar grades.

But if the work should ultimately be found unfitted for grammar grades, we still feel that we have established a great benefaction in finding out that primary grade children and their teachers work to much greater advantage and satisfaction in cold air than in warm air.

Furthermore, in case we do not find it practicable

to use open air in the upper grades all the year round we are confident that it may be used at least half the school year to great advantage, and so we expect to begin the work as if to carry it through the entire year without a break, but if we find in December that it is not likely to succeed as we hope, it will be an easy matter to close the windows in the upper grade rooms, turn on the heat, and let the school run through the severe weather much like other schools, opening the rooms to the winds again in the spring when milder air is present and we do not need so much exercise to keep us warm.

Open air schools have been conducted in Boston this winter in something the same way as that proposed above. When the weather was severe the open air feature was abandoned to be resumed when the temperature would permit. The guiding rule should be in all cases the comfort of the children. When they are comfortable and no complaints are coming from them or their parents and when the teachers are truly comfortable, there can be no danger in the work. A surprising increase in comfort comes to the teacher in the open air. She expects to be invigorated along with the pupils, but she is rarely prepared for the rapid and extensive addition to her powers of resistance and ability to work without fatigue.

Perhaps the great value of the open air school is its elimination of fatigue. I mean both bodily and mental fatigue. With an unwearied mind and body the pupil goes into his work much more heartily and effectively. The labors of the teacher are not so largely ineffectual when the children have their vitality. There is a great gain in the openness of mind in the fresh air pupil. This makes it easy to secure attention and does away with much of the ordinary explanation, urging, and reproof

which are considered a large part of the duty of the faithful teacher.

What is learned with enthusiasm and in vigor of body and mind is not soon forgotten. What we intensely desire to learn we learn at once and with great speed. What is learned in this way does not need the ordinary series of reviews to fasten it in the mind. It may be recalled or used directly without the laborious process of recollecting which is so common in school.

A pupil only fifty per cent alive in the dull air of the ordinary school is not in condition to learn much or to learn anything well. He is usually able to compel his mind to attend to that which is put before him by authority. He may very sincerely wish to do that which his elders tell him is for his ultimate good. But his work is far inferior to that of the pupil of the same ability who is ninety per cent alive. And in many instances the partially devitalized pupil drops out of school with ambition destroyed and health impaired.

It would be a fine thing for our college entrance requirements if we could multiply the units received in the various subjects by a pupil by the per cent of aliveness which he possessed when he secured the credits. This would make the units tell more nearly the truth about his preparation for advancement. If a high school student has given one-fourth of a school year faithfully to mathematics without much absence and with fair success, he is credited with a unit of culture. Now if this work was done in hot, dry air with aching head, some catarrhal difficulty, much mind-wandering, severe efforts at times to pull the mind down to the task, and other handicaps which ten degrees too much heat and thirty per cent too little humidity in the air entail upon the student, we cannot consider the unit of culture worth nearly as much

as that of the student who has pursued mathematics with a sound mind in a sound body in air that is right, and with a real desire to know the subject. It is quite probable that the latter's work is worth twice as much as that of the former.

It is the business of the school to impart culture. At present it is impeding the progress of the pupils and hindering the work of the teacher by the bad air in which the work is done. Making invalids or partial invalids of pupils and teachers, the school is wasting a vast amount of time and energy and crippling the ultimate usefulness and ability of the pupils for all time.

If the air of the school may be pure, sweet, cool, and invigorating we may expect to add to the stature, the strength, the mentality, the efficiency, the cheerfulness, the enthusiasm, and, in fact, every desirable acquisition which the pupil ought to possess for his highest good. It also adds to the comfort and efficiency of the teacher.

For these reasons, and because I have seen them worked out in actual practice, I believe the greatest question now before the public is that of right air.

CHAPTER VIII.

Mental Alertness and Robust Health are Cultivable.

The children in the first four grades of an ordinary school spend four or five hours a day for two hundred days a year for four or five years getting work done which is not worth the sacrifice. All the teaching of those four or five years may be given out by a moderate instructor in about seventeen hours

The teachers do their best and so do the children, but the humiliating fact remains that the precious hours of childhood are consumed and we have a pitiful acquisition to show for the trouble, the tears, and the striving.

At the end of the fourth school year or grade, which may mean the fifth or sixth year of actual work in the schools, a child knows how to pronounce words by looking at them laboriously. He can write his name and sometimes is a pretty good slow writer. He knows numbers up towards one hundred fairly well but not with any certainty. He has some musical culture, so-called, some art instruction of doubtful utility and correctness, can spell some words with some hope of finding them correct, and has some general culture along the lines of kindness to animals and human beings, folklore, science, nature study, and physical training.

What does it cost him?—He loses veracity. He becomes a dissembler, pretending daily to know what he has been told to learn. He knows how to cheat in spelling and copy in arithmetic. He can keep his eye on the

teacher and perform some shady tricks without being detected. He has catarrh, frequent headaches, indigestion, unnatural sleep, catches cold on suspicion, and manifests a flabbiness of muscle and nervousness of disposition which makes his outlook for maturity rather dark.

But he is so much like the rest of the children that not much attention is paid to these defects. We have come to look upon them as incident to human nature at that age. To be sure no one child must have all these defects after attending school four or more years to do four years' work, for I am speaking of the average child and some individuals are strong in physique, morals, or intellect, and can show a better inventory of contents than I have outlined for the average youngster.

A good many die during these years who might be saved. The vigor of the child is impaired by his school life and whatever juvenile disorder assails him finds him ready to yield.

Worse than all this, he loses will power—He accepts the proffered course without protest or with a mild one. He consents in two directions, towards authority and towards the crowd.

He yields implicitly to the demands of the teacher, the policeman, the stern parent, and the bully. He yields whatever the crowd happens to determine without using any reason or common sense. I do not intend discussing these things here, but I merely enumerate them in the list of possessions of deficiencies in the child who has spent time enough in an ordinary school to get through four grades.

It is bad for a child to yield habitually, for he is going to be asked more frequently in this world to do what is wrong than to do what is right, and if he habitually falls in with the overtures of the asker or the urging crowd,

he has a slender bulwark against vicious assault. While he is too young to have either reason or judgment well developed it is better for him not to become habitually a consenter. The man who is always a good fellow and not stuck up has his future heavily mortgaged, and the woman who habitually yields rather than seem disagreeable is not likely to be a great help to society. And yet it is passing strange that the first few years of a child's life apart from the home are spent where the only ones who exercise their will power are the bad little boys.

Good health is worth more than learning. I put that first. It is not down in our course of study, but it is contemplated, I suppose. But if it is contemplated, the courses unwisely give the main feature little hope of success, for the time of school is so crowded with formalities that there is no time available for either teacher or pupil to consider the most important thing. I do not mean that the ordinary school course does not talk about health. We have some excellent talks on hygiene, some fine didactics on strong drink, narcotics, and even the drugs which have never been named to the children till they come to the injunction never to try them. And we also have teaching of first aid to the injured and action in an emergency. But all this is talk about something remote and at the very time it is going on there is often going forward a troop of evils much greater than those mentioned in the lesson.

Now the difference between allotting time to consider health and making provision that the children shall be well is very wide. Our first aim should be to make the children well and strong or to see to it that the school does not sap their vitality.

The air in a school is the most important subject of all—Let us examine the schoolroom air a little. As you

step into a school you can frequently see the air, or the mixture that serves for breathing. The cloud of chalk dust, sharp plaster of paris finely ground and driven about by blackboard erasers, is always in evidence in the morning in the average schoolroom. But most of us close our eyes to this. We have seen it so frequently and buried so many tuberculous friends that it has become quite the customary thing. It goes with the school.

So, ignoring what we see in the air, let us use our noses. The olfactory organ is somewhat unreliable. It becomes fatigued readily. When first one steps into a schoolroom the air is nauseating, but after half an hour one's smelling powers go out of action and the first strong protest is forgotten.

Where does this air come from and how does it become so stifling? It is usually driven in by a large fan. It is from outside, but full of street dust loaded with germs of all the foul air diseases. Rarely is it taken from a high place. The intake has decaying papers and filth clinging to the screen which is put there as a mere pretext for cleanliness.

From the intake the air passes to a heating chamber. It may rush over red hot boiler plates or it may go through the openings between hot steam pipes. Then it passes through ducts leading to the separate rooms of the building. It is mixed with cold air to make it enter the room at the right temperature, and there you are! Your schoolroom is right in temperature. Sometimes there is an elaborate pneumatic equipment by which dampers are tripped to keep the temperature between 65 and 70 degrees Fahrenheit all day without attention from anyone.

The engineers are proud of such a system. Behold the perfection of it! The teacher is relieved of all responsi-

bility for the condition of the room. In fact, the matter is taken entirely out of her hands. If she feels oppressed, foolishly, of course—for how could an intelligent being feel oppressed in the presence of a perfect delivery of rightly warmed air and plenty of it?—if she feels oppressed, she is positively forbidden to open a window. Opening a window will spoil the system of the entire building. She is liable to censure if she dares tamper with the system. So she simply consents to sell her vitality and stay in the room till nature forces her out of it an invalid.

The air of the school is vicious as a rule—It is said to be completely sanitary, but everyone knows better, though few who suffer from its effects realize where the difficulty lies. Lack of humidity and high temperature do the mischief. When air is taken from out doors in cold weather and warmed to the temperature required for school it requires a great deal of water to make it fit to breathe.

"But," says the school engineer, "we have provided a supply of humidity for the air of our schools." Barely, my friend. I do not know of one school in the United States except the one in which I am principal and a few conducted by friends who have followed my advice, where the air that is delivered to the schoolrooms is supplied with moisture sufficient for prevention of schoolroom diseases. There are provisions for washing the air to get the dust out of it. Those are good as far as they go, but some of them are entirely ineffectual when it comes to supplying humidity.

Humidity must be supplied in the form of steam. It will not evaporate from falling cold water fast enough to do much good when the air is rushing through it rapidly. Pans of water stationed in the intake will not yield

enough evaporation to humidify the air. One may think so when he sees how much moisture is taken up by a pan set where this warm, dry air can rush over it and lick it up. But a test of the air that has passed in this rushing haste over the surface of many pans of water shows it is drier than the desert of Sahara. That air will kill the hardiest cactus God ever made. It is deadly. It robs children and teachers of vitality. It is a wonder that any are alive to tell the tale since the perfection of recent heating plants which are simply drying kilns. Pronounce that word "kills," that is the way the dictionary indicates its pronunciation and the dictionary is right in this instance.

So we turn on the steam—We have drilled holes into the warm air chambers in this school and inserted three-quarter-inch pipes with steam cocks through which live steam right from the boiler is delivered where it will do the work of humidifying the air before it reaches the schoolrooms. This enables us to turn off the heat to a great extent. Air that is naturally humidified does not need to be hot for comfort. Sixty is warm enough if you have enough humidity in the air. Supplying humidity is equal to putting a soft, fleecy, and weightless garment about the person. There is such a sense of relief when one steps into a room at sixty with plenty of humidity! It reminds us of the balmy air of a summer's day when the sun is behind a cloud and the scent of flowers greets our nostrils.

What do we do on a summer day when the sun runs the thermometer up towards ninety in the shade? We wear the lightest of clothing. We seek a spot where the temperature is about sixty-five. We sit gratefully down in that atmosphere and enjoy perfect bliss. But here! In the winter when we have our heavy underwear and

a thick suit, we make a great fuss if the temperature of the room is not seventy, or even eighty, some of us weakened ones. Is the room which is at a temperature of sixty too cool for you in winter when your resistance ought to be up a bit, you who in summer can take sixty with pleasure in your summer clothing? Something is wrong. It is that the air heated lacks humidity. That summer breeze which you enjoy has a saturation of about seventy per cent. That room where you suffer chills is warmer than the summer breeze, but it lacks humidity, for it has less than fifteen per cent of saturation. It is drier than any known climate on earth. Any spot found with an average of double that amount of humidity and the same temperature is a spot where neither plants nor animals can subsist.

In such an atmosphere the life of a child is crippled—He is not merely tortured by the discomfort and pain attending confinement in such air, but he is prevented from using his mind rightly, and his mind and body both suffer permanent disability. We have found by practical experiment the following surprising gains from housing school children in cool air humidified or in open air rooms, the results from the cold open air treatment being much better than those from the cool humidified rooms:

Pupils desire to learn and are able to use their minds intelligently. Their skin is not parched as often occurs in ordinary schoolroom air. Their eyes, ears, and other sense organs are not dried out and impaired for life. Their breathing apparatus is not filled with diseases. Their bodies are not weakened so that the least physical effort tires. They are free from those habitual headaches which they formerly suffered in school. They are able to think. They can remember what they have read or what they have heard. They perform the work of the school natu-

rally and as if it were proper to children of their age, not requiring the forcing methods which skillful teachers have to adopt.

It is natural to be well and strong—Children treated to open air teaching or to cool air humidified acquire mental alertness and robust health even when they come to us suffering with stupidity and weakness. Within a week the difference appears. It should be regarded as criminal to make a child stupid with hot, dry air and then taunt him with his stupidity. But this practice is very common. Now that we have found out how to get rid of nearly all the stupidity of children we ought to bring the whole educational system to a very great state of proficiency. We ought also to apply the same principles to ourselves and give our homes, offices, and public buildings air that tends to clearness of mind and kindness of heart.

If we wish to be well and mentally alert, or if we desire the same for our children, the road is clear now to attain these ends. The air we have been generally using in cold weather heretofore, is the cause of the greater part of all our illness, weakness, and failure to think. It will soon be considered as shiftless for the housekeeper to give the family and guests bad air as it is now to permit the furniture to wear a coat of dust. Stores and offices are soon to be shunned by the public unless they are supplied with pure, sweet air, cool and sufficiently humid.

The head of any concern employing men or women will soon have to reckon with the problem of supplying air which will tend to success and vitality on the part of his employes. The church that serves up last week's air warmed over and full of microbes will not long have a chance to improve the religious character of the people.

However much of theory there may be in the foregoing, this one fact is clear, for it has been proved beyond

a doubt: Mental alertness and robust health are cultivable, rapidly in children, and surely in adults, by application of right air.

CHAPTER IX.

The Difference Between Hard Study and Spontaneous Cerebration.

A photographer who goes about snapping his camera regardless of the light conditions is looked upon as of unsound mind by those who know what is necessary to a good plate. There must be a certain flood of light on the object, the time of exposure must be calculated, and the conditions to a good reproduction must be met or the plate will be wasted and a poor piece of work done. It takes as much time and expense to make a poor plate as it does to make a good one after the conditions of light are settled.

The same thing obtains in teaching. It takes fully as much time to explain anything to a child who is not in condition to take it in as to explain it to a bright one, In fact, because of his dullness it takes much longer to make him see the point. Teachers have a custom of following up their explanations with questions to see whether the facts have been received properly. When they find they have failed in their explanations, instead of finding out why they have so failed they go over the same subject again and again.

This repetition is endless in school, for it is considered necessary to tell the same thing over many times, frequently running up into the thousands the number of

repetitions and reviews necessary to fix a small fact in the mind.

The number facts are each represented more than a thousand times before they are lodged there to suit the requirements of school. Probably the facts in the multiplication table are ordinarily repeated 100,000 times each by the children in school before they are fully burned into the mind indelibly.

Lessons are studied over and over—One of Dr. Gregory's "seven laws of teaching" is, "Review, review, review, with fresh consideration and thought." It is the only resource when the minds of the children are not wholly capable of opening to a subject. Part of the work is done one day, it is repeated endlessly in the subsequent days, and the children are blamed for lacking in attention and for not studying the thing privately to make sure of fixing it in mind.

When children are drugged with any narcotic they cannot be expected to retain what is told them or what they read. In school there is fostered by the conditions prevailing where we have what is called scientific ventilation, a toxic effect upon mind and body which prevents any lively reception of knowledge such as will cause it to be retained in the mind in the natural way. This also prevents the same knowledge from being reproduced when needed without a great deal of hesitancy, doubt, and inaccuracy. For many years instructors have vied with each other in devising means for getting ahead of the lethargy of school and causing quick acceptance of ideas by their pupils. The success of a teacher is often measured by her ability to present matter to a sleepy and enfeebled class so they will arouse themselves sufficiently to retain part of what she gives them.

The natural orator feels this when he has an assembly

to address. He may not be able to give a reason for his procedure, but he goes over the matter in various ways, repeating many times if needs be the main points he wishes to emphasize, knowing full well that the average auditor is dull and needs school methods applied in order to make any permanent impression on his mind.

A noted attorney made a practice of giving as many repetitions of his counts as there were men in the jury box. If there were twelve men on the jury, he told the argument off to them twelve times over, using different words and illustrations to send the thing home. If the teacher could get off with telling twelve times any important bit of history or geography which she wishes to lodge in the minds of her class, she would feel that a great load had been lifted from her.

The ironworker does not follow the school methods in dealing with metal. He does not undertake to make a casting by putting pulverized iron into his sand molds. He could spend endless time in putting cold bits of iron down the holes and letting them roll to the spots where the parts of the casting are to be formed, but he knows he cannot get a solid piece of work in this manner. It would keep many men out of mischief if they were set at work breaking iron into small bits and putting them into the molds, but there would be no castings.

And yet the teacher does almost as foolish a thing. She has her diminutive bits of information. She gathers her pupils before her in an atmosphere which produced weariness. She keeps the place quite still so no one may be disturbed. She places the little bits of information where they ought to go as nearly as she can judge, and then she pretends to expect they will stay put.

It requires the fervent heat of molten metal to make a casting. Cold particles of iron will not hold together

when placed in a mold, no matter how skillfully. Neither will much information be found in the mind of a pupil who has had the elements of it put into his mind when the mind was not in condition to receive them. There must be an equal fervency of desire to know, pleasure in accomplishment, joy in acquisition, to make knowledge permanent in a child's mind to that required to make a casting.

And so, when the teacher wishes to add anything to the stock of knowledge already possessed, she must weld the new upon the old with fervency. There must be a condition in the mind of the child to receive the new information if we may hope to have it remain. Any amount of cold pounding will not make a weld. It will make heat and perhaps the teaching, when the child is not fit, will make sufficient heat to resemble the real thing, but there will be no weld unless there is enough fervency.

So if the light is not strong enough for a good exposure of a photographic plate or the heat is not fervent enough to make a good weld or unite particles in a casting, so the mind that is exercised on a subject at a time when it cannot produce the requisite amount of attention and interest in the process, fails to comprehend and the teaching falls off in efficiency and becomes something else than teaching.

The simile is not perfect, but it is nearer the truth than most of us seem to think, judging by general practice.

Let us try another comparison. Suppose a young man courts a young woman who admires his ability and appearance. She feels that he has enough property and ability to keep her from coming to want and to permit her to make that conspicuously wasteful display of clothing and ornament which many women desire. So when he proposes to her, telling her of the love he has in his

heart for her, she answers, Yes. They go before the clergyman in a ceremony which the law calls for and are pronounced man and wife.

In the eyes of the law she has become his wife. But in point of fact she may not be his wife at all. Unless she feels in her heart a warming at his approach, a thrill of pleasure in the thought of his coming, an accelerated pulse when she hears his voice, she is no wife to him. He marries her believing she loves him, but the very thing he anticipated and believed he should find is lacking. There is no real reciprocation of love and there is no such ideal union as is contemplated in the institution of matrimony.

She may be true to him in a mechanical way and yet not measure up to the standard of a wife. And a child may go through his books in the same perfunctory manner, never waking up to the possibilities and the delights of acquiring knowledge in the right manner.

I think the simile of the photographic plate is probably nearest to the truth, for whatever the exposure, you get some result. It may be only a blurred plate. In the case of putting iron particles into a mold without heat, you get nothing at all, but when you try to teach a child who has no interest or only a fictitious one, you get at least what corresponds to a blurred plate.

The shout, "Eureka," goes up when a real discovery in knowledge is made. There is something corresponding with it in every healthy act of the mind when an obstacle has really been overcome. Who ever heard Eureka in a hot, dry school? It is possible that something can be done under the most unfavorable circumstances, for the human mind and body are wonderfully constructed to withstand grief and hardship. It it were possible to endow iron particles with the accommodating qualities of

the mind and body, you would sometimes get a cold weld or a casting without heat. But it would be the exception to the rule rather than a frequent occurrence which might be relied upon.

Getting pupils into a condition where the shout Eureka may be put up occasionally is the prime business that school authorities should bend their energies towards. We are too much given to the practice of feeling that if a child spends time enough on a subject, he has the subject. In Oxford university the student sleeps for his degree. If he lies in a bed a certain number of nights each year for four years, after he has matriculated he will get his degree regardless of what his attainments may be. Of course, if he goes in for honors, he has to work. But the theory at that great center of learning is that a four years' residence within the corporate limits constitutes a liberal education.

In America the custom is to graduate pupils from high school when they have taken certain subjects so many hours for so many semesters. It is considered impossible for a boy or girl to learn anything except in keeping with the works of the clock. There is no provision whatever for the Elihu Burritt sort of a boy who has his grammar beside his forge while he works at a trade and gets a living and an education at the same time. There is no thought that the Lincoln-like fellow who can devour a book at a sitting really is worth looking at or considering in making up credits. Unless he has sat in the stupefying schoolroom a certain number of hours while the class was considering certain subjects, he cannot be credited with knowing any subject even though the instructor happens to realize that the boy knows more about it than he himself.

As an apprentice must serve his time to satisfy the

rules of his union, so a student at any of our ordinary schools is expected to put in a certain number of hours a week before being entitled to a credit in any branch. The lack of definite knowledge of what a student does makes it a matter of general guess-work on the part of the teacher who marks percentages for students, and that teacher or subject is preferred where the students consider the teacher is an easy marker. The choice of subjects in our high schools which are now conducted on the elective plan is largely a matter of selecting subjects which will be easy to get good marks in regardless of the use of the subjects in after years.

One young man is reported to have sat in several classes without any intention of passing. When asked what he was taking replied that he took "gym and lunch."

Now the difference in actual worth when school life is over between the student who has succeeded in getting good marks all through his course and the student who has merely taken what he has been compelled to take to graduate is not as wide as educators are trying to make themselves and their pupils think. The efficiency of our students does not insure equal efficiency in after life and the failure of a student in school is no indication at all that he will not succeed in life. It is notorious that many of the veriest dunces of the schools have become leaders of thought and action a few years later.

In the light of these reflections let me state that I think we are not getting vital work out of the best students and the difference between what is done by the most brilliant student and by the most unsuccessful one is not as great as it ought to be. The school ought to be a place where the success of a student positively means more than it does today. In other words, our school-life ought to be more vital. It ought to make the whole

thought of the student richer. It ought to influence his life more effectually than it now does. It ought to be such that his ordinary thinking will be accomplished more easily and naturally and that thinking ought to be more to the purposes of life than they now are.

We ought to conduct the work of our schools so that students might become enraptured with their studies instead of trying to get marks. We cannot do this in the air that is now regularly supplied. Hot, dry air kills enthusiasm and life. We must get the kind of air that gives life and desire to excel, and not merely that, but the ability also to so excel. If to do this it should require an entire recasting of our courses of study and a rebuilding of all our schoolhouses, the end would amply justify the means. But no such revolution is needed. With properly humidified air the temperature may be lowered from five to twelve degrees. This alone will set the students generally free from the lassitude and weariness in which they now labor. It will clear up the breathing passages and make the pupils more capable of close and persistent thought. And above all, it will so enliven them that they may seize upon the truths of science and the forms of language with avidity and delight and may remember what they wish to retain with no laborious processes of committing to memory things which simply tire the brain and are forgotten as soon as not required for passing purposes.

I think we cannot hope to make our work vital in air like that now being given in the average school. We are ruining constitutions and depressing the hearts of those who naturally are ambitious. Suicide is not entirely unknown in schools and I believe that a proper supply of healthful air would correct morbidity in the discouraged student and reduce the number of actual

disasters through lack of ability to succeed in school work.

There are more pupils dropping out of high school every year than graduating. They enter the high school with a great desire to finish the course. They take it awhile and find they are not capable of carrying the work on as administered. Not knowing why they cannot succeed, they conclude it is a fault of their mental endowment, and so they drop out of school with the belief that they are not up to the average in intelligence.

Many students are simply "frozen out" of high school. I have known a principal of a high school to say, "I do not see why such a pupil persists in coming here. He cannot do his work. I thought we had him frozen out last year, but here he is again, failing regularly and persistently."

Now I think it is a fine thing for a pupil to stick to the course even though he is unable to do the work. It is a fine thing for the child to wish to enter high school when he has not the mental equipment to do the work under the circumstances prevailing. But it would be much finer if instead of trying to discourage such ambitious inefficient workers we could bring into their lives a thrill of success and give them the bounding health which would send clean blood pulsing through their veins and make them capable of those things which heretofore have been to them a blank or an impossibility.

Clean, moist air at a low temperature will so assist the brain in its work that the pupil who is a failure in hot, dry air will make a great success in right atmosphere. Giving the right kind of air gives powers of mind and body which are very important in school. To make the work of our schools so vivid as to become more beneficial to our pupils we ought to foster every agency which will

wake up the mind and intensify the instruction. The greatest agency known for this work is the kind of air we are using in the Graham school in Chicago.

Every specialist in psychology admits that his best work can be done only where there is a vivid and comfortable flow of ideas in the mind he is trying to benefit. Take, for instance, the work of the memory expert. He knows he can do nothing to improve the memory unless the brain is well supplied with good blood. He also demands that the thing to be remembered must be attended to strictly. The measure of attention governs the measure of success in committing to memory. He who has the power of attending to the thing to be remembered has the power to remember. Now the power to attend depends on the condition of the body, and the conditions which obtain in the ordinary school are exactly wrong in this vital matter, and the result is that children generally from our grammar schools seem to know little of what they have been taught, and those who have been through the high schools simply point to the credits on their card when asked what they have got out of the high school course. It is the commonest thing in school experience to find students who say, "I had that once, but of course, I have forgotten all about it."

The student in hot, dry air is sick—He is drugged. He needs what I am pleading for, lower temperature and humidity in the air. He needs to be free from the diseases which are induced by that hot, dry air. He cannot exercise his faculties until he is relieved of the conditions of air which are hurting him and also relieved of the effects already fastened upon him by that dry, hot air.

It is entirely within the limits of reason to say that a student who lives in right air can accomplish one hundred per cent more in a year than the one who lives

in the air that kills cactus. The acts of mind which are evoked in education are so much more vigorous in right air than in warm, dry air, that we may get the natural efficiency of the student only when we give him the right air and cause him to live in it for a long time.

All the study done in wrong air is injurious. All the study done under proper guidance in right air is educative. The action of the undrugged mind is healthy. The action of the mind subjected to the effects of ordinary school air is weak, sluggish, and uncertain.

Better an hour of real study than days of pretense. Better results come from a truly alert mind in a brief effort than from a fagged brain kept long at tasks.

CHAPTER X.

Death in Infancy and Childhood.

Why does the baby die? Many little children lose their lives at the time when they are most lovable and most loving. Fresh from God they come to us and many of them go back almost directly. Statistics are not available to show what percentage of all the babies born in this country die in the first year of their lives. We do not know how many are lost to us early in their school career. But observation shows that many die, and the scientists are right when they tell us that many of these children die unnecessarily. They might be saved to grow to manhood and womanhood.

Census Mortality Bulletin No. 104 says that annually in the United States from 100,000 to 200,000 babies under five years of age die from preventable causes. Dr. Cressy L. Wilbur, chief statistician for vital statistics of the census bureau, who prepared the bulletin, says this great loss of life among the little ones could be prevented. Present knowledge of sanitary measures would save them if we could apply it.

More than one-quarter of a million babies die in our country every year under the age of twelve months.

Of the children dying annually under the age of five years it is estimated there are fully 400,000.

This is wrong. The farmer does not lose calves in this wholesale manner. Colts die if not properly cared

for, but those who are in the stock business find out what to do for colts to save them. Pigs do not show a mortality in the first year at all comparable with that of human beings.

What causes this brutal death rate among babies and little children?

They die because they are unable to resist—Their vitality is low. It is made low by the conditions in which babies and little children are compelled to live, if live they can. They are not permitted to take in the life giving and vitalizing forces of nature which pure air affords. They live in close rooms where germs thrive and multiply. They are not allowed to feel upon the surface of their bodies the impact of cool air which is essential to capillary action of blood. Their peripheral circulation is cut off because the skin is kept away from the stimulating influences of cool air and water.

Sometimes they are prevented from having the exercise which nature demands. They are swathed in bandages and woolens, pinned and wound up so tight that their little limbs cannot get freedom of movement. When muscles are kept still they lose their natural force and weakness ensues.

Preventing the action of the blood in flowing through the capillaries next to the skin stagnates the whole system. It is probably worse for the health and strength of the child than confining its limbs to prevent muscular activity.

For one poor child in America suffering from lack of sufficient clothing there are a hundred dying of weakness caused by too much bundling. We coddle our children into the grave by withholding fresh air, by keeping them inactive, by preventing the natural activity of the capillaries lying just beneath the skin, and

by discouraging in them by physical constraint most of the activities of muscles and circulatory organs which are essential to hardy vigor.

We exclaim against the folly of the Chinese foot-binders and the Indian Flathead custom of binding a board against the forehead of the infant to make it beautiful. We say these follies cause pain and destroy natural efficiency, but we forget that the Indian and Chinese are less foolish than we in our customs of "protecting" our children from the beneficial influences of occasional applications of cold and from the invigorating effects of naturally free motion of limb and body.

Weakened parents do not as a rule rear strong children. Much of the difficulty in bringing up healthy children lies in the fact that the home is wrong and the parents do not live rightly themselves. Children of weak parents, nervous, irritable, excitable, morose, hypochondriac, and weary, have small chances of living even if taken away from their insanitary home and its insane rules. But if they must try to live in such homes, the homes which have weakened and destroyed the health of the parents, the children have slender prospects of arriving at maturity.

Water-logged timber goes to the bottom of the stream. Lumbermen in all parts of the world rely on natural water courses to carry logs to the mill when such streams are available. But it usually happens that the hardwood log which lies in the water too long does not go down stream with the current but goes to the bottom and becomes a snag.

Living or dying is like floating or sinking. If the specific gravity of the timber becomes slightly less than that of water, the log goes down stream. If the vitality of the patient is reduced slightly he dies.

It is hard to get the water out of a stick of timber so it will float after it has once hugged the bottom. But it is a very easy thing to raise the vitality of either a child or an adult. The method of doing the two things is almost the same. Put them out into the sunshine and nature will do the work.

It is marvelous to behold the work that nature does for the child who has been too much housed and too much coddled when he is once permitted joyfully to play and perform his school activities in the open air. It is pitiful to see the wasting form of a little one in its mother's arms fading out of the reach of her help and love, passing gradually beyond the reach of human help, fading like a flower that is deprived of air and moisture.

It is criminal in the people of our great country to permit these things to go on without vigorous protest, when remedies which will save life are at hand and the knowledge is in the minds of those who have observed and should be brought to the minds of those who suffer or have the care of those who are wasting away.

Pure air and exercise give life—They raise resistance. They promote activity, and activity is life. They give joy. Joy produces vitality.

Close rooms, warm air, thick clothing, and "taking care" are causes of death as surely as the gunshot directed at the heart or the assault of the tiger.

Is it any less fatal to the child to be killed by intended kindness than to be killed by neglect?

Does the lone traveler in Alpine snows lie down to a more painful death than does the child suffocated by hot treatment in a mansion with loving relatives agonizing about and killing themselves with anguish and stuffy air?

Is it really so much worse for a man to die with his

boots on, with God's open sky above his head and a feeling in his heart that he meets the last enemy like a man, than to have the curtains drawn, the house hushed, downy bed furniture embracing him, and regularly administered drugs forcing the body to make a number of unavailing and desperate rallies for the purpose of prolonging his last agony?

The dance of death goes madly on through our civilization with this change in the order of the play: In the old miracle play, Death called to him people of all classes, he beckoned them, they hung back, he urged them to follow him, they remonstrated, but at last with loud protestations of despair and agony, all went behind him in the dance which swept them from the land of the living. Now Death is invited. He is given a golden ticket to the house and asked to call early. Everybody in the house conspires to get him to enter. All rush towards him with an apparent desire which almost makes him forget his office and become reticent about the matter of business which pertains to it. Languidly and wearily they ask him to take them, and when he gently folds them in his arms they have no remonstrance to make, they are too weary of life to resent the embraces of death, and they go away gladly.

There are few who die in these days who have sufficient spirit to put up any sort of a remonstrance or plead for a lengthened term. The physician of today will tell you that he finds all his patients, as a rule, quite ready to go, many of them ragardless of the consequences in the world to come. They have lost vigor, they are unable to make the effort to live, the poison of fatigue runs in their veins, they feel it will be such a relief to drop the responsibility of breathing, and there is rarely a death in any house where "all the modern improve-

ments" are "enjoyed" that is not accepted by the patient much as the weary child drops off into a dreamless slumber when the cares of the day have been by far too strenuous.

Death comes because vitality and the desire of doing have fallen off. Full of weariness, the heart stops beating The functions of the body discontinue.

Children die because their resistance has been taken away from them. They do not yield up their lives to any special disease, as a rule—they merely cease to struggle in the unequal war. Often one disease pulls the child down, runs its course, and is succeeded by another which comes in its wake. The system throws off the toxin of one malady merely to accept that of another. Measles or chicken pox may not be the real cause of death, but the physician decides it is as well to say the child has died of measles. What he means is that the resistance ran out when the child was in the course of a case of measles, and when the resistance is low enough death ensues.

Whatever is done to stop this brutal death rate must be done along the line of raising the powers of resistance in the individual. The resistance of all members of society must be raised. As we are now living, the resistance is running down for the whole race. This means that child mortality is on the increase.

If timber should change its style of growth and take up just a little more silica from the soil, all logs would sink.

If we lower the resistance of the race a very trifle, we shall double the death rate among children.

If we pursue a line of legislation, school administration, and house regulation which will raise the powers of resistance just a little, we may cut child mortality

rates in two in the middle. A very little application of intelligence—a general adoption of cooler houses, moister air, and more out-door activity—will save us millions of premature deaths.

Judging from what I have seen already in a kindergarten where the children do their work with wide-open windows, we can save 100,000 lives annually in the United States by finding out how to run open-air schools for little children.

100,000 lives of children are worth the effort—I may have the figures too large. But I suspect I have them too small. Statistics of birth and death in America are not reliable or complete. Neither are all the benefits of open air schools found out or estimated. But we know enough now to believe the results are simply marvelous and worthy of the most earnest attention of all who wish the race well or care for the banner which floats over the land of Lincoln and Washington.

Let us examine some statements supplied by the document referred to in the opening of this chapter. Dr. Wilbur quotes Professor Irving Fisher where he says that of all the diseases of infancy having the median age one year, 47 per cent may be prevented; and that of the diseases of childhood having median age two to eight years, 67 per cent may be prevented.

"It does not seem unreasonable," Dr. Wilbur states, "when we consider the fact that there is apparently no reason why infants, if properly born, and this means simply the prevention of ante-natal disease and the improvement of the health and conditions of life of their parents, should die at all in early infancy or childhood, except from the comparatively small proportion of accidents that are strictly unavoidable.

"The possibility of great saving of human life during

infancy and early childhood is emphasized by the estimates made by Professor Irving Fisher, on the basis of independent medical opinions, for his Report on National Vitality to the National Conservation Commission, as to the 'ratio of preventability (postponability),' that is, ratio of 'preventable' deaths from cause named to all deaths from cause named for certain diseases of early life.

"Out of every 100 deaths that occur from each disease in which the median age at death is under 5 years, there could be prevented the following numbers: Premature birth, 40; congenital debility, 40; venereal diseases, 70; diarrhœa and enteritis, the most important cause of infant mortality, 60; measles, 40; acute bronchitis, 30; broncho-pneumonia, 50; whooping cough, 40; 'croup' (which means diphtheria), 75; meningitis, 70; diseases of larynx other than laryngitis, 40; laryngitis, 40; diphtheria (under its proper appellation), 70; scarlet fever, 50.

"The possible saving of life for 'general ill-defined and unknown causes,' including 'heart failure,' 'dropsy,' and 'convulsions,' median age 35 years, is 30 per cent. The median age of 'convulsions' alone is less than one year, and it is probable that at least the ratio of preventability of diarrhœa and enteritis (60 per cent) would apply to it. The term is an indefinite one, being expressive merely of the symptoms attending the true cause of death; nevertheless, no fewer than 6,450 deaths were compiled therefrom for 1908, although, in compilation, any other definite cause is preferred. The term is no longer employed by well-informed physicians in reporting causes of death, and it is possible, by inquiry made by the local registrar immediately after the receipt of this and other unsatisfactory statements, to practically

eliminate them from the returns, as has lately been done for Chicago.

"In the light of the figures quoted above it would seem that practical sanitation has only made a beginning in the work of preventing the occurrence of infant and child mortality. The ground has only been scratched over. Deep stirring of the soil and thorough cultivation of all the means available, with our present scientific and medical knowledge, for the guarding of young human lives would produce startling, and from all past human experience almost unbelievable, results. Public health, as a function of government, is itself only a creation of the middle part of the last century, dating from the utilization of the knowledge available as a result of the operation of the English laws for the registration of vital statistics (1837). Even in England, however, no systematic efforts have been made until very recent years to utilize to their utmost possibilities the facts already known. The infant mortality of England was higher for the years 1896 to 1900 than for the years 1861 to 1865, and no marked reduction in the early rates occurs until the present decade.

"It is time that greater attention be given to the subject in the United States. The prompt registration of all births and the more careful and precise statement of causes of death by physicians are essential. Such terms as 'convulsions,' 'marasmus,' 'debility,' and the like should no longer be tolerated when the true cause of death can be determined."

Children are dying like robins blown out of their nests by a tornado. We may stop much of it if we will. It must be done by better living at home and by better treatment at school.

I have been asked many times by anxious inquirers.

"What can you do about the dreadful home conditions? Can these children who are given fresh air in school live in the terrible home conditions to which they return after the school session has closed?"

I wish I could make my answer plain.

Open-air treatment of children at school does not by any means make them less capable of contending with the bad home conditions. It simply fortifies against them. At the school we make the children strong enough to live through the time they have to spend in the bad home.

We raise the resistance. Is it not better to have the resistance raised five hours of the twenty-four, even though it may be run down during the rest of the time, than to have the whole twenty-four hours devoted to lowering the resistance?

If a man on the desert can find manna in the early morning hours and it will not keep, would you deprive him of getting strength from that manna by eating it in the morning merely because he will have nothing to eat during the rest of the day?

By open-air school work we take the water-logging out of the timber and enable it to float. Possibly two-hour stretches of open-air work would save many lives among those who are almost weak enough to die, but who in such short intervals of natural life-giving environment will get a small increase of vitality.

Vitality is like capital—Save your money whenever you get a chance. The rainy day is surely coming. Get something ahead. If you are living from hand to mouth you will surely come to distress.

If a child's vitality is low enough so his life swings merely in a balance, as the lives of thousands in our schools are doing today, any slender contribution to that

vitality to increase it at any time is a gain for all time.

No child is too strong. He may be too strong for the comfort of some elderly person of low vitality who has to live in his neighborhood. But no child has more vitality than I should like to see him have. I do not care to introduce bleeding into the schools for fear children may get too strong for us to handle them.

I should not advise the mother to ask the surgeon to let a tea cup full of blood out of her child now and then for fear he may become too vigorous.

But I am asking that a process now going on which is more dangerous than bleeding be ended.

Sapping the blood out of a child is no more deadly than thinning the blood. Take out millions of red corpuscles and inject water, and are you improving things? Destroy the white corpuscles and their power of chasing and destroying harmful microbes in all parts of the body and fill their place with inert matter, and have you not done the child as great a violence as to withdraw part of his healthy blood?

We ought to have growing up about us, in our homes and in our schools, a throng of merry children, full-blooded, vivacious, mischievous, and thoroughbred. We ought so to live that our offspring may receive from us, not stocks and bonds into which water may percolate while we sleep, but blood that is thicker than water and vitality that will make them superior to the needs of physical life and capable of taking a manly part in every manly occupation and a womanly part in every movement where women are permitted by the men to officiate.

I wish to head off this dance of death. I wish to see the resistance of children brought up to a par with that of the rats born under the barn. I wish to let them have that which they cry for, outdoor treatment with a dry

skin and a chance to breathe freely and move their limbs naturally. I wish them to live—not at a poor dying rate —but to live in vigor, joy, and capability. I wish them to grow naturally and not become runts. I wish them to receive the vigor which God intends to be the heritage of those who live north of the frost line.

Cold fresh air and freedom of movement will accomplish what is desired.

CHAPTER XI.

Dust and Death.

Here is something we haven't proved yet, but I think it true. Air that has its temperature raised from outdoor winter cold to 70 or more degrees has its capacity for vapor increased from sixteen to twenty-two fold. Its rapacity for something to fill the interstices is enormous. It amounts to a steam vacuum and something must fill it if anything fine enough can be found. So it seizes upon every minute particle of dust available and carries it floating about where it may dodge into the breathing tracts of the pupils at any minute.

These particles are dangerous both from their sharp nature, sometimes cutting the tissues and opening a suitable entrance for disease germs to get into the blood directly, and also from the fact that they are carriages for germs which might not reach our breathing tracts if it were not for the fact that the air takes them up and carries them to us.

Dust catarrh is common. Many persons have a severe "cold" after a dusty day. Others contract a nasal discharge if they merely enter for a very short time a room where dust, either visible or invisible, is flying about.

Dr. W. A. Evans, Health Commisioner for Chicago, has some pertinent words on dust in his bulletin of March 12, 1910:

"The most harmful trades, such as stone cutting and metal polishing, have five times as high a consumption rate as the least harmful, such as bankers and brokers. The worst living houses have an average rate only twice as high as the poorest. Therefore, bad working places are more harmful than bad living places.

"There are two reasons for this:

"One is that the air is dustier in bad working places than it is in bad homes. The heavy, cutting dust from metals and stone hurt the lungs so as to make it easier for the consumption germ to get in. Disease germs in air are the worst harmers. Next comes heavy dust. Befouling with bad breath and other gases is less important than either of the others. Therefore if you are a young man do not choose a dusty trade. If you are already working at such a trade do not work alongside or near a consumptive, do not work where the sunshine cannot reach all around you, do not work where a breeze is not blowing, do not work in a dusty place, in a shop where health is not safeguarded. To do otherwise may send your family to the poorhouse.

"The second reason for the larger amount of consumption in shops is that a larger number of people mingle there. If you take a cigar factory with 200 men working, you will usually find at least one consumptive among them. In more than one-half the cases he will be a careless and therefore an unsafe man. You now have tubercle bacilli, dust, bad air, and susceptible men all in the same room. Other cases are sure to follow. The chance is that among 200 men gathered together promiscuously, you will always find one careless consumptive. Can the proprietor afford to hire a careless consumptive? Can the others afford to work with him?

"In the home the number of persons is small and the

chance of a consumptive person's being among them is smaller. In many homes consumption never enters, and the chance, therefore, of home contagion is small. But when there is a consumptive in a house the other members of the family are in great danger unless the consumptive is very careful. The members of such families should have themselves carefully examined, even though they feel well. If they discover the disease in themselves while they are still feeling well they can certainly get well. When the member of the family has died, the room should be disinfected, but it is very much more important that the members of the family should be examined with tuberculin and by physical examination."

Dr. Evans places greater stress on danger from dust than from bad air, and yet the schoolroom is always very dusty even where elaborate ventilation renews the air every minute.

The school where chalk flies in the air almost constantly, the school where they use plaster of paris crayon and the air is extremely dry so as to cause it to fly about in very fine and never disappearing particles, is quite as dangerous as a marble cutting establishment. There is equal reason for insisting that such a school be thrown open to the winds of heaven as that the shop where marble is cut and worked shall be thrown open. If it is wise for the workman to protect his health in this way by getting into sunlight, flowing air, and general cleanliness, we ought to be equally careful that the school where our children sit gets as reasonable treatment as a shop.

The school is doubly bad. The stone works are dangerous because of the dust, and the factory where two hundred men are together is dangerous for the second

reason that one in two hundred is tuberculous and careless. If there is but one in two hundred tuberculous in school and careless, there are found then in every large city school from five to ten careless consumptives who are doing all they can to pass the disease on to well children.

Examine the basement of a school. It is supposed to be the place where children may play. It is deadly. It is very dry in winter. It is so actively used by the pupils that there is always a fine accumulation of pulverized stone and cement on the floors ready to fly with the first disturbance. Imagine what goes on when a thousand children rush to these dry basement rooms and begin to play games and chase each other.

The consumptive child spits on the floor just as the others do. The saliva of hundreds of children are here dried and mixed with that fatal dust which goes into the lungs of our children all the more prepared to take life because of the nature of the dust, but because it has freshly ground into it day after day sputum of consumptives.

There is no wonder that consumption is spread in schools where the basements are used for play. The wonder is that any children who play in them have sufficient resisting vitality to throw out the germs of disease and remain well and strong. The basement air is not as good as that delivered to the schoolrooms. It is usually much warmer. It is very dry, it is often also foul. Such air robs the children of their vitality and leaves them weak and incapable of resisting the ordinary attacks which would be made upon their lives if they were not doubly exposed to contagion and dust attack by playing in the basements.

There should be a rule in every city that basements

should not be used by pupils except under urgent necessity. Instead of making them, as is frequently the case, the gathering places for all children whose homes are less attractive, all the vicious who wish to get together for obscene purposes, all the weak who collect there to keep out of the weather which at the time may be slightly inclement, and all the robust and vigorous youngsters who enjoy pushing in where there is a crowd, we should abandon them.

Probably fifty per cent of the children of Chicago at this writing spend several quarters of an hour daily in basements of this hot and dusty nature where the air is stirred violently by rough games and the fanning of dresses. Fifty per cent is a low estimate, and yet there are children who spend much more time than fifteen minutes in the basements and toilet rooms in the basements of our schools when once they get into them.

The rules require the opening of the buildings at eight o'clock for the admission of pupils. Teachers are not there to watch them. They come on duty at 8:30 or 8:45. There are children in those basements the full hour every morning, and in the noon ninety minutes some of them are back there within a very few minutes after the twelve o'clock dismissal. There are children in Chicago, who, under the rules, are present in the basements and toilet rooms more than fifty per cent as many minutes as they are in the classrooms. They are not the choice pupils, to be sure. But they are worth saving for their own sakes and they are worth keeping out of those places for the sake of the other children who mingle with them there.

There is a wrong notion of what a basement does in a school. It is supposed to be a good, dry shelter for children who have no good homes to remain in. It is

supposed to be a fit place for children to play on a rainy day. It is supposed to be the kind of a place that will be beneficial to young people to gather early in to avoid the inclemency of the weather. These suppositions are extremely false. The basements of our schools are ex- extremely dangerous to life and morals. They should be guarded as vigilantly as the penitentiary walls. No child should be permitted in any school basement except in times of urgency. The habit of families of children to throng into the basements immediately on the opening of the school doors should be broken up by measures sufficiently severe to remain in force long after the first spasm of correction has passed away.

If toilet facilities for use in school hours are maintained near the schoolrooms, properly inspected and looked after, they are useful to a school. But the basements for play and indiscriminate gathering before and after school with their toilet rooms open at all times and unguarded are among the most menacing institutions of the times.

A new policy has just been adopted by the Chicago board of education regarding basements for play. There are to be none. Broader corridors that may be used as playrooms on rainy days have been substituted and are to be a feature of all new buildings. The first structure to have wider halls and no basement is the three-story addition to the Fulton school. It has fourteen-foot halls instead of the ten-foot ones common to other buildings of recent erection. A solid concrete foundation takes the place of the disease-breeding basement.

The close smell should have another name more indicative of its true character. The Scotch Education Department in its report on the cleansing and disinfecting of schools, 1907, says:

"The 'close smell' so familiar in the schoolroom is due partly to the subtle organic impurities of the air breathed out by the children, partly to the decomposition of organic dirt on the children's bodies or in the room. Such decomposition is normally caused by microbes. Hence, to cleanse a schoolroom properly, it is necessary to destroy the germ-life as well as to remove the visible dirt. This is why periodic disinfection is advisable, even when no known infectious disease has been present. The particles of dust act as rafts to convey microbes of every sort from place to place."

Spray disinfection is recommended and free airing of rooms. "All class rooms ought to be flooded and reflooded with fresh air for as many hours a week as circumstances render practicable. Windows should be opened at every possible opportunity, and should remain open except when the weather makes closing necessary. In our climate, the air is never too cold for a healthy person to breathe."

"Held as a crime" is the expression of Professor S. Homer Woodbridge in his special report on the condition of the air in the schools of a certain progressive American city. He says:

"If the aggregate of all expenses of sickness, and of the values represented in vital and mental energy lost; in broken health and premature death; in retarded educational development in scholars, and in the diminished intellectual force of teachers, is the result of bad air, officially furnished schoolrooms, taxpayers are justified in condemning the practices which are responsible for them as malfeasant, and in demanding that such faithlessness be held as a crime. If such losses and suffering were the result of deliberate design, their causes would be liable to criminal procedings and severe penalty. Be-

cause they are due to negligence rather than design is not a sufficient reason for the offender's immunity from punishment."

CHAPTER XII.

Some Diseases Caused by Dry, Heated Air.

In considering the diseases we suffer from because of dry, heated air, I do not expect to cover the whole ground or to treat the subject as a physician. I merely wish to enumerate some of the ills suffered on account of this great error of the American people in warming their schools and homes and show how some of them have already been cured by the application of rightly humidified air at the proper temperature.

Air that is fiercely hungry for moisture sucks it up at every spot where any water can be found, and in the human body there are several important organs which suffer materially by this attack of air in search of water. The breathing tract is of course the most obvious, and that I shall mention first.

The nose is the seat of the sense of smell. There is a good share of the year when persons living in warm, dry air are deprived of this sense. The rapid evaporation of moisture from the interior surface of the nose causes a change in the cells of the mucous membrane so that they may supply water to the air and neglect entirely the function for which it is designed.

When the cells have been enlarged and the mucous membrane has attempted to secrete water rather than its own proper fluid evaporation takes place so rapidly that even with its new structure it is unable to keep pace with

the demand. The nostrils become very dry and harsh, the sense of smell being temporarily suspended, or the lining of the nose secretes a great amount of watery fluid which comes with a rush and then ceases, drying into masses of accumulations which invite the lodgment of disease germs.

Diphtheria is one of the common diseases which are caused by this derangement of the mucous membrane. While the secretions from the throat and nose are normal diphtheria germs cannot colonize upon the throat. They are either killed by the secretion or sent down in the washing of the breathing tract which naturally goes on all the time when the air is not too dry to permit this function to proceed undisturbed. But with the drying of the air and the lowering of the resisting powers of the patient diphtheria soon fastens upon the mucous lining of the throat and the whole system becomes impregnated with the toxin of the disease.

Laryngitis and pharyngitis are common where the air is warmed without moistening. While not so liable to become fatal as diphtheria these diseases prey upon the strength of the patient and cause, to say the least, much discomfort and loss of strength. As neither disease is liable to obtain a foothold in the mouth or throat of a person who breathes much fresh air, we may conclude that these two diseases are largely caused by our lack of proper moisture in the air we are compelled to breathe.

Adenoid growths and swollen tonsils are very troublesome to children before they enter school and afterwards unless removed by a skillful surgeon or by a more humane process which has but lately appeared. These throat growths sap the vitality of the child and disfigure him for life, changing the formation of the bones of the face and preventing heathful breathing. Twenty years

ago the child study experts told us that adenoids are growths which may be readily removed by anyone who will insert the finger into the throat of the child, find the growths, and firmly scrape them off without the use of any surgical instruments.

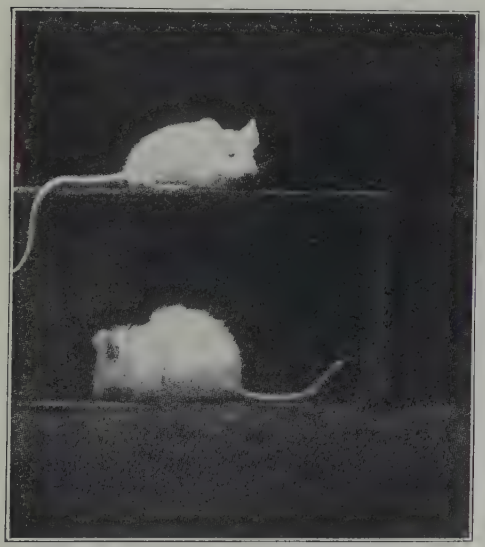
This simple treatment was discontinued shortly afterwards when it was found that infection sometimes sets in after adenoids have been removed and it has lately been considered highly important that these growths be removed by regular surgery with all the care of a difficult operation. A special form of cutting instrument has been devised to go into the throat and make the incisions at the exact spot where the best results may be obtained.

But infection setting in at the point of the cutting or scraping off of the growths sometimes finds its way to the eustachian tube and travels thence to the inner ear, causing serious inflammation and damage there.

The German specialist, Czerny, observing the difficulties attending this operation, and feeling that the disease itself might respond to treatment opposite to the cause of the disease, began treating adenoids with nothing but pure fresh air, causing the children having adenoids to go through certain exercises calculated to bring a good supply of pure air into contact with the adenoid growths. This was found to be successful and is known as the Czerny lymphatic treatment.

This treatment has been adopted to some extent at Bellevue hospital in New York city and in an orphanage there exclusively. By giving the children breathing exercises designed to aerate the nasal passages and the breathing tract below it, it was found that adenoids shrivelled up and disappeared. The same treatment is given for swollen tonsils with the same gratifying results.

APPARATUS FOR DETERMINING THE QUANTITY OF POISON IN AIR EXHALED BY MICE.



THE PROTECTIVE EFFECTS OF ANTI-FATIGUE SERUM. Both mice have been inoculated with fatigue poisons. The alert animal was previously injected with the serum; the other—almost asleep—was not.

Hearing of this treatment recently I resolved to do what I could to avoid surgery in these cases in my school district. I had seen a child of my own recover from an attack of adenoids merely because of fresh air treatment and felt that the new method was of great importance. My little daughter had adenoids and was examined by our family doctor who told us it would be best to have them removed. As her mother was under stress at home at the time owing to illness in the family, we deferred the operation. Complications took our attention from the child's need of an operation for nearly a year.

In the meantime she had frequently taken walks with her mother and they had a habit of practicing deep breathing every time they were out together. When we were ready to have the operation performed the deep breathing in open air, or some other agency, had removed the adenoids.

One day my school nurse inquired specially about cases of adenoids in the school, saying that the nurses were generally pushing that matter at the time and many operations were being performed. She had been in the hospital with four cases that week and expected to go with more. She stated that it was extremely disagreeable and painful to her, as the children have to take an anesthetic and the bloody surgery and apparent discomfort of the child worked upon her sympathies. Recalling the New York report, I immediately requested her not to take any more adenoid cases or swollen tonsils from my district to the surgeon till further notice.

I called the board of health and asked the physician then in charge whether we might not have the benefit of the New York experience and discontinue taking children to the surgeons for these troubles. He asked for details of the report and stated that he would be willing

to put into operation a milder treatment if it could be relied upon.

When the school physician arrived I asked him to give directions in the open-air rooms for deep breathing and other exercises connected with deep breathing calculated to cause swollen tonsils and adenoids to disappear. He was already familiar with the Czerny method and the exercises are being regularly given. We believe they are having a good effect, although at this writing it is difficult to state just what the results are, for we do not go into the throats far enough with our school inspections to determine the presence or absence of adenoids in all the pupils and I suspect many children had them in a mild form at the time we began the deep breathing. The improvement in the general health of the children and the shrivelling away of tonsils which were enlarged before the treatment was made an exercise of the school, convince us that we are not liable to be called on to visit the surgeon with any cases of tonsils or adenoids from the Graham school where these exercises are practiced.

These two inflictions which so many children suffer are direct products of the bad conditions of air in the homes of the children, for the enlargement of tonsils and the growth of adenoids are usually well developed before children are old enough to enter school. If there could be fresh air and humidity in the homes of the children there would probably be no cases of either disease. Suitable diet is required in severe cases, but the main remedial agent is pure out-door air.

Eyes and ears have been receiving much more attention in our schools of late than ever before. It is found that many children suffer defects of vision and of hearing which militate against their success in school. In the

past five years thousands of children in Chicago have been sent to consult oculists and opticians. But as a rule there has been little done in a general way to find out the causes of these defects. Probably because many of them, especially those of the eyes, are congenital it is taken for granted that the causes are too remote to demand attention.

But when one considers what dry, heated air does to the breathing tract it seems entirely rational that its effects must be deleterious to both eyes and ears. The relief our pupils and teachers have experienced in the feeling of their eyes since we have humidified the air and reduced the temperature convinces us that there is almost as much to be gained in sight and hearing from having the air made right as in seeing specialists and applying remedies after the trouble has begun.

Stepping into a dry heated chamber one notices at once that the eyes burn and smart with the rapid removal of water from them. The ears are assailed in the same manner. They dry out and become less efficient. The eye and the ear are lined with mucous membrane and each has its own appropriate secretion which preserves the wellbeing of the organ of sight or hearing as the case may be. Now if extreme evaporation must go forward on the surface of this membrane because the air is extremely dry the secretions of these tracts change in their nature to become more and more watery until the cells of the membrane change and harden and a dryness ensues.

This is noticeable in the eyes in the smarting sensation which follows entry into a room where the air is excessively dry. This mistreatment of the eyes alone is a sufficient warrant for taking extreme measures to secure a natural degree of humidity in living rooms and

in school. When the eye becomes weakened by the attacks of dry, warm air it not only adds to the discomfort of the patient but contributes to the nervous strain under which he lives, so that life is less tolerable to him and this partial loss of his most used and most abused sense is a serious matter to him.

When the ear dries out and fails to secrete the natural wax which nature provides for its health and protection, the hardening of the tissues produces either pain or deafness or both. The ear does not respond to maltreatment as readily as does the eye, but when once it has begun to dry out and neglect to care for itself it is much slower to respond to sanitary treatment and the cure of deafness or hardness in the ear is not an easy matter. Most of us lay the failing sight and loss of hearing which are so common to persons of advancing years to the process of nature which cannot be avoided, believing that it is merely a symptom of age. But those who have experienced the relief which comes from a proper treatment of the human body to right atmospheric conditions feel that too much is laid at the door of advancing age.

That tired feeling which many persons experience when they have reached the age of forty is spoken of frequently as the coming of senility. Old age does not lay hold on us at forty, and even at fifty the man who has lived where the air is right may defy the calendar. Dr. Osler's dictum merely shows how complete the American people have surrendered themselves to the demon of dry air and what a general weakening of tissues and forces follows.

There are many persons past forty who consider themselves ready to be Oslerized who are merely steam-heated. All they need for their rejuvenation and refreshment is to get into a natural atmosphere and per-

mit it do its work in their tissues. Whoever has kiln-dried his frame for months every year is weakened so that his usefulness as a factor in the world's work is largely diminished, but he is not beyond hope. There is a relief for him which will surprise him if he will but give it a fair trial.

Probably there is no more depressing and discouraging sensation than that of the steam-heated man who believes his condition is brought about by advancing age. It is similar to that of a child in school who has been unable to think to order and whose head is stuffed with pus so that his mind refuses to work and his senses are diminished in power so that life looks to him in his early years as a dread waste not worth traversing.

The debilitating effect of dry air is simply remarkable, and why we have not more fully recognized it ere this is a mystery. We buy furniture frequently because we say this machine made stuff has not the lasting qualities of the old hand made pieces of our grandfathers. There is much in this difference in workmanship, but there is more in the difference in the fiber of the lumber used. Our lumber is kiln-dried before being made into furniture. Then it is worked up and sold.

When it reaches the furniture store it is there subjected to a much drier atmosphere than that in the drying kiln where it has had its moisture sufficiently extracted for working purposes. In the show rooms of the dealer it remains a time in this intense, dry heat which tortures salesmen who do not know why they suffer from drafts where the humidity is low. Then the furniture is sold and comes to the home where it strikes a still drier atmosphere than that of the salesroom.

Here it shrinks perceptibly in every joint and shrieks out its agony when the first strain is put upon it. The

glue in the joints forgets to hold and the joints themselves forget to match, and the result is that the poor "machine made" furniture falls apart and is consigned to the furnace to contribute to the downfall of the next new pieces which are brought in. The truth is the machine made furniture is really in most instances stronger and better fitting than the fine old furniture of our grandfathers. The accuracy of the machine puts the parts together with a fineness of adjustment impossible of attainment in hand joinery.

Your new piano comes to you from the warerooms under similar conditions. The chances are that you gave away or traded in an old instrument which would have been quite as good as the new one had it received treatment suited to the requirements of a tense and finely made instrument whose parts are metal and wood of various sorts in which high class glue forms an important part. Your old piano was split in the sounding board, the action had become somewhat debilitated, and possibly the strings were rusted. Worse than this, this old piano had acquired the vicious habit of not staying in tune.

When you found your piano so unreliable in the matter of staying in tune you concluded it might be good for some poor person to learn on, but for music in your home you require a perfect instrument. So you got rid of the old and brought in at a large cost a piano of larger frame, heavier metal work, and more exquisite finish, perhaps thinking you were going to get one that would meet the requirements of your home.

Alas, my friend, you cannot buy a piano that will stand the test of atmosphere in your home. Not if your house is warmed without a live steam arrangement for giving out humidity. Every particle of wood in that

piano is going to shrink in a short time. It will remain good through the summer, but with the advent of cold weather and the drying heat you are going to send about that instrument there will be a shrivelling up of every particle of wood and the piano is going to show signs of debility before you have had it a year. The maker, of course, guarantees it to be a good piano. His guarantee is against any defect through faulty workmanship. He has a habit nowadays of giving you a twenty-year, or a twenty-five-year guarantee, but it is meaningless as far as the real failure of a piano is concerned.

The crucial point in a piano is frequently in the tuning pins. They fit into wood so tightly that they hold the strings firmly at a required tension. Then when the piano goes into a room where the air is worse than that of the kiln from which its parts are taken to be worked up, the wood about the tuning pins shrinks a very little, and a very little shrinking there makes the piano worth very little indeed. You ruin your piano by baking it slowly.

The human frame is more delicate than the piano. It has the peculiar power of withstanding bad treatment and making repairs and offering makeshifts when the real thing is not to be had. But it is weakened and deprived of its powers by the application of the air we are considering and it cannot retain its vigor under such adverse circumstances as most of us are subjecting our bodies to every year when cold weather advances. We become much like the old piano, rickety and uncertain. We are still able to make a great deal of noise, but the music has died out of our souls and we lead a cheap and sorry life as imitations of the real thing, which nature intended we should be fully as much as the piano manufacturer intended his instrument to be a high class one.

Then we blame advancing years for that which we are too obtuse to understand, and we turn on more heat and cuddle closer within doors, feeling that whatever comfort this life can possibly yield us in the warmth of our retreats we will enjoy for the time still remaining to us, and so by our foolish action in an emergency we increase the difficulty and invite debility and dissolution instead of repelling the invader and securing for our homes, our offices, and our places of amusement atmosphere which restores to the human system those peculiar thrills of pleasure which belong to pulsing life and which are lost to the one who lives in warm, dry air and permits his vitality to be sapped by it.

Of the diseases of childhood which are directly due to this wrong air I have spoken elsewhere in this work, but I will add here that swollen tonsils, diphtheria, most of the diseases peculiar to childhood and called children's diseases, bad eyes and ears, catarrh, all the foul air diseases, such as grippe, pneumonia, and laryngitis, as well as consumption, are either invited to enter the weakened system which has been subjected to dry, hot air or they are bred right there because of the action of this wrong atmosphere.

There is no tonic like good air, especially when the system has been deprived of it. The latest treatment for a child having pneumonia seems to be to give no drugs whatever, but to open the windows so that a draft passes directly over the patient, and then wait for the action of nature in removing the toxin of the disease.

Indeed so wide is the range of disorders that arise from living in wrong air that one may be fairly safe in prescribing moistened air at a lower temperature for almost any ailment that comes upon one.

CHAPTER XIII.

American Dry Rot.

Blessed is the man who has laid his hand or his cheek against the satiny surface of a fine piece of oak which he has been carving or fashioning for some definite purpose. It resists his tools and shows a toughness that is delightful. Even the silica in it which dulls the cutting edge and makes a peculiar grinding sound as the shaving is pared off gives the workman pleasure.

But that is sound oak. There is other oak which gives no man pleasure. He is ashamed to strike it with the ax for the purpose of burning it. It has fallen from its high destiny of being strong timber and is powdered away in a mysterious manner which is not well understood. How a fine stick of timber, kept in a dry place and well cared for, can give way to dry rot is beyond comprehension, for it is the nature of good oak to be good.

Men decay still more strangely. They lose ambition, efficiency, nerve, pertinacity, vigor, will power, and most of the things that go to make a man.

Some of them acknowledge their weaknesses and lay them to early indiscretions. I know a man who laments the weakening effects of the intemperance of his early years. Now the intemperance of that person was hardly more than stumbling over a pop bottle in a temperance alley. It never weakened him in the least. I know

another who mourns lost power through excesses which were probably not sufficiently excessive to overthrow a mouse; but he gives up and thinks life has lost its call for him. Another tells me he was crippled in his youth by the hard work he was compelled to do when bound out. He says his family are all tall men and women and he is a little runt, killed off half way by arduous toil.

Piffle! Let us examine the matter. Some of us will see the point, and some will act. Others are too far gone to have the efficiency to observe a life preserver flung among them. Some are forty years or more of age, and they have been tired since that birthday and some time before. They would not acknowledge it before the fortieth anniversary came round; but after that they saw that the time of a man's efficiency is before forty.

Some of these self-styled decrepits are resuscitable.

Will you pardon my abruptness in this important and serious matter? I am a teacher. I am accustomed to lodging ideas in heads that are thick, in brains that are weak, in sensories too enfeebled to work unless severely jolted.

The reason they are such numskulls is that they are like your own children whom you have treated to just what you give yourselves, and that makes blockheads of the brightest.

Not age weariness, or labor stunt—The trouble with you is the way you live. I put this directly at the reader because I hope the need for a book on this subject will be short lived. The country is rapidly learning about right air. The reader is less far gone than the rest and so I appeal to him, for he is not beyond help.

Dry rot, or something so like it that the name will apply pretty well, has taken hold of people generally in

offices, homes, schools, factories, and public buildings in the northern half of the United States in the last quarter of a century. It came in with the use of what is known as scientifically ventilated buildings. We have our systems of ventilation and they get the foul air out of our buildings and the vitality out of the occupants.

When a family goes into a steam heated flat for the first time a heat of sixty-five is good enough for all of them, I am told by an old engineer. The next cold season he has to give them seventy. And the third year you cannot get it too hot for them. There are many indoor people who cannot endure a temperature lower than 75, and many are happy only when 80 is reached.

That is suicide. It is rather slow; but pretty certain. The reason for all this is a little complicated, but it is worth while following the matter up.

Steam is lacking—I mean what I say when I say steam is lacking. I mean of course humidity. But that is a more scientific and less understood word than steam and steam is exactly what I mean.

Man has a notion that all the steam in this world is of his manufacture. He thinks he has it cooped up in his boilers and in his kitchen stove furniture and there is little steam anywhere else except in the volcanic and hot spring sections of the earth. But he is wrong. There is so much steam all about us out-doors on a winter's day that you will doubt my word when I say that the atmosphere at zero temperature is usually full of steam. Miles above us on a summer day there is steam mixed with the air.

I say mixed. It is not in chemical union with the air. It is independent of the air. The schoolboy knows that air is a mixture mainly of four parts by bulk of nitrogen, the gas that does nothing, and about one

part oxygen, the world builder. He also knows that these two gases are simply mixed as peas and beans are mixed, not chemically or even physically joined as the component parts of a pudding. If you mix peas and beans you call the mixture peas and beans, and you may add more peas or more beans, still it will be peas and beans. So will the atmosphere be atmosphere all the same if you decrease the amount of oxygen or increase its proportion.

And everyone knows that there is a pressure of the atmosphere, about fourteen and a fraction pounds to the square inch. But it is not generally known that there is a separate and distinct pressure of live steam mixed along with the atmosphere and entirely independent of it.

A queer thing about it is that the air expands when heated and the steam contracts as its temperature rises.

It is common knowledge that water will boil at a lower temperature in a vacuum pan than in an open one. It boils with less heat on a mountain than in the valley below. We make steam whenever we bring water to boil. And now you think of it you know that boiling can be carried on in a partial vacuum when the receptacle is so cold that your hand may rest against the dish without discomfort.

You have tried one of those little bulbs which have water in them and a partial vacuum, so that when you take one in your hand the warmth of your hand causes the water to boil within the glass bulb. And now you know that boiling can go on in as complete a vacuum as we can devise with the temperature of the water 20 degrees below zero Fahrenheit.

Steam is not necessarily hot—Steam may be perfect, live steam, and be cold. We do not know what limit for steam is on the side below zero. And that is not neces-

sary to our purpose now. I merely wish the reader to be accustomed for the time to think of steam as cold. It is out there in the sky all about us. True steam. And it belongs in us and in our apartments where we live or work or sleep. It is essential to our life. Without it we die. Plants die without it. Animals cannot exist without steam in their environment. I mean steam.

Now our present fine systems of ventilation, and our vile systems as well, deprive us of steam. They make a steam vacuum in the air where we live. I mean a partial steam vacuum.

Steam exists in the atmosphere regardless of what the atmosphere is or whether there is little or much of it. So much steam will occupy a cubic foot of space whether there is any air there or not. No more steam will go in than belongs there at that temperature if you pump the air out. The air and the steam do not crowd each other at all. They co-exist, side by side, in the same space at the same time, making what is a paradox, for we all learned once that no two bodies can occupy the same space at the same time. But steam and air do that very thing. I suppose your professor will show you the fallacy in my statement and say the steam exists in the interstices between the mixed nitrogen and oxygen. But steam and air occupy their full allotment of space either together or apart without interfering with each other.

When the temperature of any space rises, the air expands and there is less of it in a cubic foot; but the steam contracts and there is more of it in the cubic foot of space, provided it can get there.

Pardon me, if I write too simply, for I am simply shouting because it is necessary to shout to the general run of suffering mankind afflicted with dry rot.

Steam vacuum introduced—If we heat up a room full of air or a house full of it without opening a window, we expand the air so it forces its way out of the house to some extent, and we diminish the volume of the steam, and other steam tries to get in to take its place. But while the air gets out easily through the accidental openings like those under doors and beside windows, steam cannot get in at the same sort of openings with equal facility. So while there may not be any perceptible pressure of air in the room from having too much air packed into the space, there is a decided suction or vacuum of steam in that very space because steam from the outside cannot get in as readily as air can get out. It takes a rather large opening for enough steam to come in to humidify a room but partially. It cannot get in fast enough even though there are several large openings. So there is a partial steam vacuum in every building or room heated from a winter out-door temperature to 70 degrees, the common standard of engineers of ventilation.

Where there is that steam vacuum there is no comfort for man or beast. A sudden desire to do something desperate seizes most persons when they find themselves in a steam vacuum. All the vile things in their nature come into play. A nervous excitement comes upon some persons so they feel they must scream when they enter a church or other public place where the steam vacuum is dangerously tense. The result is that we do many things for which we are truly sorry afterwards. In fact, we are sorry for them when we do them, but we are impelled by the force of evil which belongs to the vacuum of steam. We are temporarily unbalanced, partially insane, in such atmosphere.

Naughty children and divorces—The area on earth where the divorce evil is greatest and where the children

have least respect for their parents, is probably the northern part of the United States where we have hot, dry air in our homes, offices, schools, and public places about two-thirds of the year. It makes men and women hanker for something they have not. Anything different will suit them better than what they have. They are impatient with everything about them, thinking the fault is in the people and in institutions rather than in the atmosphere.

Children are specially ungrateful to their parents when kept in these drying kilns which our homes resemble and outdo in their deathly dryness. They feel that the parents do not know what they themselves know, are not able to discern ordinary things, and in fact such parents are obtuse to many things which the children in their freshness see clearly at a glance. The children are brighter than their parents, because they have not so long suffered the deadening effects of hot, dry air. Because they are brighter they think they know more. The result is that there is no more living together in peace.

"How sharper than a serpent's tooth it is to have a thankless child!" says Shakespeare, the out-door man. If he had had experience in the houses of the well-to-do American families, he would have had to get something sharper than teeth to make his simile worth while.

Domestic bliss in the tea-kettle—I feel that there are some women reading these lines. If so, dear madam, will you kindly permit me to suggest that at the next recurrence of that ungovernable disposition of yours when you are simply compelled to say things to your husband or your children which bring tears to your eyes even while you speak, you rush out into the kitchen,

put on the teakettle, boil it hot as quickly as possible, open a few windows, lower the temperature of your apartments, and humidify the air with steam instead of with hot tears.

There is a charm in it. It beats praying to heaven for help. God helps those that help themselves, and those who so far forget their own value in this world as to shut themselves up in steam vacuums with the temperature running above seventy, are almost beyond his help.

Maybe you have been using that elegant chafing dish to charm other men or to make other women jealous of you; but you may now annex it to your prayer book and be good. I mean good. I don't mean that you are going to be able to curb your temper and smother vicious tendencies. I mean that you will not have the temper or the tendencies to any such extent. It will not make an angel of you, but it will make your husband and children think you are one, and that is better than being one.

To humidify a house—Do not imagine your house is humidified if you have a tank in the furnace jacket. It is set away from the furnace where it merely gets warm but not hot enough to make steam. It takes steam to humidify, not evaporation. When you consider the swiftness of the flow of air through your furnace and the exasperating slowness of the process of evaporation from warm water you will see the folly of thinking a water tank can humidify. It is a help to be sure. About as much as the straw to the drowning man. It is clutched at. But it takes from four to twenty gallons of water to humidify a modern small dwelling so as to make it fit to live in. A gallon an hour is not a large estimate for a residence.

But, says one, if we had a gallon of water running

through our house in the air it would spoil things! No, that is an error. Things are spoiled because a great quantity of air is running through the house looking for a gallon of water every hour and getting all it can out of the noses, throats, and lungs of the people in there. It is making adenoids in the children and swollen tonsils. It is making tuberculosis, perhaps. It is watching its chance to make pneumonia. It is ruining your piano and shrinking the pinblock so it cannot stand in tune. It is taking the glue out of your furniture. It is ruining your home and your happiness. It is taking from you your vitality and your hopes of heaven. I beg of you to drown your sorrow in a flow of steam.

It must be live steam. Get it wherever you can make the provisions for it, but do not think you can get it in any other way than by throwing live steam into the air somewhere. It will spread rapidly enough if it can only get into the air to start with.

Steam is quick—It will beat a trout that jumps against the current in a mountain stream and surmounts waterfalls twenty feet in height. Note which way the wind is. Open a window up-stairs on the side of the house where the air will go out, not in. Station your family at intervals about the house before you open the window. Ask them to shout when they feel a fine, cool sensation from the window you are going to open up-stairs. Throw open the window. The air rushes out. But while the air is rushing out something is coming in right through the air. It is your life-saver, steam. It can run in at an opening while air is rushing out at the same space and in the very same portions of that space. You cannot see the steam come in or the air go out, but your family will severally whoop so soon after you open the window that you will all be surprised to think the

grateful coolness from that window has reached all so soon.

It is not cool air rushing in, for no air is entering from that window. It is the steam coming to fill the partial steam vacuum your furnace or other heating plant has formed there to your detriment. That steam is your friend. It is your very life. If you do not get it you will die. If you get only half enough you will be half dead all the time. If you get less than half enough you will be worse off still.

It matters little where in the open house steam is permitted to escape. It will travel from the kitchen up two pair of stairs and it will go down into the basement. But it must be supplied in some way by boiling water. At the point where it escapes into the air, you will need to use some caution, for enough of it will spoil the wall or the near furniture. But after it has found its place in the air it will do no harm, so protect things within a few feet of the escape of steam and there will be no more danger.

It will help your plants, your children, your temper, your furniture, your hair, your skin, eyes, ears, smell, taste, and religion.

To humidify a large building—Have you a factory, an office, a store, or a school to manage? Do you care for efficiency in your employes? Is it not true that where men or women work on piece work you are loth to let one of them occupy a place at a machine or a bench if inefficient? Well, the air you give them is of such a quality as to prevent efficiency. It kills. I mean people are dying in your employ when you could save their lives if you knew the value of steam to them while at work. After reading this their blood will be upon your head if more of them die from this cause, and if their

lives are still made miserable by your neglect, you will at least know where the blame lies. There is no form of ventilating and warming apparatus which may not be corrected so as to drop the temperature from seven to fifteen degrees and make everyone comfortable.

And you will save money by it. The cost of coal is greatest when the heat is run to extremes. It takes far more coal to raise the temperature of a building from 65 to 70 than from 50 to 55. We find that in a large plant or a small one, from eighteen to twenty per cent of the coal is saved by using steam in the air to make the lower temperatures pleasing and satisfactory.

The air is soft and balmy. The vital powers of all are raised at once. I have a report on what happened in a half day in a building of fourteen large rooms. Putting the temperature down to 62 to 64 we made all comfortable by humidifying the air, and then the reports from those in charge of the rooms averaged up that there was an almost immediate increase in efficiency of from eight to ten per cent. This was raised as time went on. But these figures are for the first few hours' work in the new right air.

Perhaps the reader has never known any right air indoors. If so, it is time now to get that experience. It is cheap. Nobody has anything to sell to make money from your patronage in this line. Just see that the steam is turned on somewhere. You will love your wife better right after. Your accounts will come out right and look better on the page. Your help will co-operate better, your competitors, even, will be less formidable. It is grease to your old clogged business wheels.

Get rid of the dry rot. Where human beings thrive there is steam on the windows in cold weather. Let us see that it is had in every place where people live.

CHAPTER XIV.

The Steam-Heated Woman.

It happens that women live nowadays in quarters where the temperature is something over seventy on the average. Not that it is intended by themselves or by others to keep them thus warm, but circumstances are such that they spend their lives largely in that temperature. Since this is the case, it is worth while to look into the matter and see what the effects are.

The principal use of woman in this world is to bear and rear children. Being housed where she has to breathe warm air and never resist cold to any extent, she becomes weakened and the offspring suffer. Not only are the children less capable of growing to maturity because of her impaired vitality, but she is not in condition to give them the mental and moral culture that she should impart.

The brain does not work right when too much warmth is applied to the body. One of the largest business offices in the world is carefully kept at a temperature of 65 because the manager says he cannot afford to pay for the mistakes of so many workers when they are warmed up to the condition of inaccuracy.

The temper is vitiated by heat—When a woman is not quite clear in thinking and somewhat irritated by unnatural conditions so as not to know really what is the matter, especially if the confinement in close air

has been long enough continued to make the woman's physique a "problem" for the special physician, then she has trying times with the children when they are really doing fairly well. Worse than that, she exasperates them to the extent that they look upon her as a queer specimen of humanity whom they must circumvent, and they circumvent her.

All this goes to show that it is unfortunate that women are kept as warm as they are compelled to be by the conditions in which they find themselves. It makes them less efficient in accomplishing the main purpose of life.

In society the heat militates against comfort and the real advantages of social intercourse. Their afternoon teas, their clubs, and other gatherings are, as a rule managed in the same warm air, aggravated by the presence of considerable quantities of toxic exhalations, because the ventilation of the house is usually shut off for fear of giving some one a chill, and so the temperature not only rises but the air becomes vitiated.

While endeavoring to be kind to each other women often find the conditions prevent kindness. A fierce and vindictive spirit arises in the kindest of women under the circumstances. Out of a single word spoken lightly or indiscreetly, owing perhaps to the confused state of the mind at the time, cutting remarks ensue. These are repeated and brooded over, and the peace of mind of whole families is destroyed.

In church gatherings which are conducted for charitable purposes we often find the most uncharitable things are said. It is not uncommon for a woman to visit the church or charity gatherings of her friends and come away from the meeting so worked up over what has been said that her spirit is far from charitable. There

are women's missionary and aid societies from which many good women studiously stay away because of the manner of unkindness which dominates the sessions.

No one seems to know why things are so, but it is acknowledged that they are lamentable. The reason is that the meetings are conducted by steam-heated women, women who live in an unnatural state of atmosphere and temperature and are incapable of the kindness which their religion inculcates or seeks to inculcate against adverse conditions. Not that the air at the place is responsible for the temper displayed. It contributes to it. But long hours and days of heated exposure in close air have so worked on the nerves of the women that when they gather their assembling is often like a red rag to a bull. They become belligerent.

The cause of all this misfortune is not one of quick action. It has been at work on the lives of most of our women for years. When children they were swaddled and kept hot. They were deprived of good air. They were trained to take cold at the lightest draft. They were weakened by a system of hot air treatment which is far more enervating than the famous hot baths which caused the downfall of the Romans.

As little girls they were kept hot, bathed hot, bedded hot, bundled up hot, and prevented from using their limbs naturally or filling their lungs.

As large girls they were put into schools where the temperature never was permitted to fall. No matter what else fell, the temperature never did it. Dusty, hot, parched air was their portion and their studies were regulated by a steam heated teacher whose conscience had been sharpened by hot air till it could outvitriol blue vitriol.

Contact between a growing girl, overheated, and such

a teacher, also overheated, was the preparation the young woman had for life. Perhaps she went to college. Not many mothers go to college. Perhaps I ought to say, not many children have mothers who have been to college. That is the way to put it. The woman who goes to college usually manages—provided she accepts a man—she usually manages, after some years, to have a child, and one's enough for her.

But the few girls who have college-bred mothers get a little better chance at first. The mothers have studied hygiene, ventilation, scientific dietetics, psychology, eugenics, and some more, and the children—I mean the child—the child gets the benefit. But it doesn't get the chance to resist normal temperature as a rule.

Such a child is so rare when you are considering the mass of girls that it is well to leave it out of the question and speak of the common girl. The ordinary girl grows into womanhood, provided she does not succumb to the care she gets, and she is poorly equipped for life.

She is better equipped than her mother was, however, for we know better now than to submit to the practices which were in vogue when the heroine of the novel was a pale beauty. We call such anaemic now. In the days of the not very remote past, the novelist found it necessary to have his heroine faint at the proper point, the focal point in the story. She always had to go off into that faint in order to get the proper effect into the mind of the reader. Now she never faints. She may take a hand in the heroic action of the finale and become, by her own physical prowess and strength the chief instrument in bringing things to pass physically so that right may prevail and the villain be foiled of his purpose.

This has come about because our girls now are outdoor girls. They ride and golf and spend much time

getting a quantity of tan. They stride and swim and climb fences without assistance. They shock their mothers frequently, but they have less occasion to call the physician on a small pretext.

Now, if we could induce the nation, especially the people living north of Mason and Dixon's line, to humidify their homes, schools, and public places, and give our women a chance to breathe life-giving air, I am sure the woman of tomorrow would be larger, stronger, and a better citizen.

She would be free from the annoyances of many things which are painful to her now, but would be barely noticeable then. She could enjoy the antics of her children better than she now does. She could manifest a better temper in all conditions of trial and stress. She could make home far more pleasant than she is now doing.

The steam-heated woman of today often says things to her children, to her husband, or to her dearest friend, which she knows at the time are unwise, hurtful, and possibly not entirely true. But she is under the impulse to do something desperate. The only course of throwing off pent up misery seems to be by the use of the tongue, and so she lets fly such expressions as she regrets before they are off her lips. Then she has a time of humiliation and sheds bitter tears over her indiscretion.

Try this experiment, if it seems to you that I am too severe in this statement of what seems to be the truth. If there is in your house a woman who uses her tongue too freely in vituperation and who is on the edge at all times with nerves which have gone beyond control, it is possible that you may find a measure of quick relief.

Get some steam to making somewhere in the house and open the doors so it may come to where she is. Open the windows or doors to reduce the temperature of the

room slightly and gradually. Avoid any sudden draft or great change of temperature which may cause a shock. But get the temperature somewhat lower in the house than she is accustomed to experiencing. But do not lower the temperature without raising the humidity. If the air outside is below the freezing point it will be necessary to produce enough steam to make a showing of moisture on the windows.

Take her into your confidence in the matter and let her know that the humidified air of a room of slightly lowered temperature is good for nerves. Let her participate in the preparation of the house for her own improvement. When the mild, soft air of the house has had a chance to affect her feelings, you will be gratified to learn that some of the tension of the nerves in the back of her head and neck, the ache in her back, and other symptoms which have been sources of agony to her have been largely diminished.

It is well worth trying where the woman is not of the sort I name, for if she is not of that sort she is surely on the road to that condition if she is living in dry, hot rooms, and she will experience immedate relief of tension even though she is capable of holding herself in check and always controlling her temper and speech.

As to the man who is steam heated, there is an equal amount of unreasonableness in him when he lives in a home where the air is not moistened and the temperature has to be run up to seventy or more. If office, store, or shop is warmed similarly, he has no nerves to boast of. He has the short, quick way of speaking in an irritating voice, which grates on the ears of the household. Such a man is often more welcome when he is passing out of the house than when returning to it. How many men there are who leave in their homes an immense feel-

ing of gratification that they are out of the way for a few hours and there will be less of the unreasonable and irascible conduct which they habitually show in the domain where they rule, not by reason of love, but by force of superior violence in vituperation!

While this chapter was opened with remarks about the woman who lives in steam heat or in any dry quarters where there is insufficient moisture in the air, it was used as a caption to catch the man. For this work will be purchased, as a rule, by men.

Steam heat is no worse than hot water heat. In fact, it is a little better when the pet cocks may be kept open or there may be a leakage in the coils, for then some moisture will escape into the rooms and humidify the air to some extent. But in a system of hot water heating, unless there is definite and adequate provision for humidifying, there is no moisture at all to be had from the coils and the condition of that house is worse than that in which steam is introduced and some of it is allowed to escape.

There is no reason to think that there is a moistening influence in either steam or hot water systems when the closed pipes and coils are the only factor in caring for the temperature of the house. Neither one is moist in any manner. There is moisture inside the pipes, but not on the outside where it is so sorely needed. There is no more moisture on the surface of either steam or hot water heating pipes than there is on the surface of a hot flatiron.

The woman makes the home—From her heart come those influences which hold the family together in bonds of affection. To her must we look for all the better elements of family life. Let us give her a chance to exert those influences without hindrance from the conditions

of the house where she presides. Now that it is plain that she is the principal sufferer because she is the home keeper, let us make conditions for life better for her, knowing that it will also benefit everyone else who has to be in the home any part of the time, and the improvement of her condition will also reflect itself in the natural influences for good which will emanate from her where she is permitted to live in a tolerable house.

Probably the greatest question to be considered by those who have the responsibility of a home upon their shoulders, is that of giving the house the right kind of air. It is easy to know when the house is warm enough if it is supplied with humidity. But when there is no supply of moisture the whim of one will militate against the caprice of another and there will be disagreement as to what the temperature ought to be. One can live in nothing short of eighty when the air is dry. Another feels pain and unrest when it gets above seventy. There is no way of harmonizing the two. They cannot possibly live together in the same temperature where the air is dry.

But harmony in the matter of temperature is quite possible when the air is suitably humidified, for the person who demands eighty will be satisfied with less than seventy within a short time. It is common for teachers who have complained of being chilly in seventy-five without humidity, to protest when the air gets as warm as seventy with humidity. In fact, there are no positive limits to which the temperature must conform if the air is properly humidified.

This is not brought about immediately, for it takes a little time for the humidity to accomplish its purpose, but a day or two of experience in natural air will fit one

to enjoy life in such air whether its temperature is sixty-two or sixty-eight. Instead of being obliged to watch the thermometer and make complaint when limits are passed, the dweller in natural air, air that has been given enough humidity to make it somewhat like that of the summer breeze, does not care particularly whether the temperature is at some specified degree or several degrees away from it. It is odd that we enjoy the various degrees of heat in summer. A range of twenty degrees does not begin to affect us disagreeably in the summer as does a variation of three or four degrees in the hot, dry air of our homes in cold weather.

Since the woman is the particular member of the household who is really most worthy of considering, let us give the house a temperature and humidity in which she can be most comfortable and most healthy. Knowing that her vitality and excellent qualities are impaired by hot, dry air, it is our duty to see to it that she has a home to live in where there is such natural air that she may be all to the family that the family desires. How much better when the trying occurrences of childhood oppress the little people if they may come to mother and know that she is not out of condition to sympathize with them! How much better for a man to come home to a wife who is cheerful and meets him at the door with that peculiar smile of pleasure which won his affections so long ago! How much better for children as they come into the world to find themselves the offspring of a mother who has that peace of mind which goes with natural surroundings and that joy in motherhood which the well woman possesses and makes so much of!

Whatever the cost and whatever the trouble, let the home be humidified so the woman who is the queen in

that realm may rule with a natural and motherly sway. Let her reign be free from unnecessary discomfort and embittering circumstances. Give her the air which God intended the mother to enjoy in the home.

CHAPTER XV.

The Open-Air Man.

The man who is reared in the open air or who has spent his youth largely in the open has an advantage over all others. I am convinced that it makes him strong in certain manly qualities which can scarcely be brought out by in-door culture. I specially wish to refer to the character of Washington who had limited schooling but much wisdom. He is but one of a splendid line of our great men who have spent the days of their childhood and young manhood where the air of nature and the things of out doors have had their influence upon them. Garfield on the tow path, Lincoln splitting rails, McKinley at mechanical work, Franklin working his way on a boat, Webster on his farm, and many others come to mind to show that those who have been peculiarly gifted in those attributes which make for greatness and for the benefit of their country have been fresh-air men, open-air people.

What shall it profit a man if he shall gain the whole sum of earthly knowledge and shall neglect to lay hold upon wisdom?

I believe the open has much to do with sanity of mind as well as of body, and that those who have been particularly useful to our country have been those who have been brought into close relations with nature in the time of the forming of their characters and their

bodies. Those who have been remarkable for their wisdom are of this kind.

Then, too, there is the matter of resourcefulness, inventive genius, and pertinacity. These qualities abound in the man who has been much in the open. Washington could not tell a lie, but he could outwit the enemy in every trial of strategy. Whether it was before New York where he built great bake ovens to make the British think he was sitting down to the siege, or in his flight from Trenton after his marvelous victory when superior forces came against him, he was the same intrepid, successful strategist. Lord Cornwallis complimented him highly for his maneuvers in getting away from Trenton after his victory, and the more we study them the more we are impressed with the wisdom of Washington and his ability to outwit the enemy.

It was not in battle alone that he exhibited this great quality. In the time of stress when the colonists had gained their independence but had not gained a oneness of purpose to establish a union and build a nation, it was the peculiar statesmanship and statecraft of Washington which brought the thirteen jealous, straggling, diversely peopled and interested colonies to agree to set up national housekeeping together. When the Articles of Confederation had been tried and found a miserable failure, no foreign country caring to deal with or act respectfully to a people which might be one today and thirteen tomorrow, the time arrived for the thing Washington had been striving for to be put into force. He wished to form a union of the colonies in one strong, central government which could levy and collect taxes, declare war, coin money, and perform the necessary acts of sovereignty which a nation only can do. And so the convention came together and debated for months. Then

the constitution was framed. But it was one thing to get it accepted in the convention and another to get it adopted by the colonies.

When Maryland hung in the balance and was doubtful about casting her lot with the rest or setting up as an independent republic, Washington crossed the Potomac with fully as much strategy in his head as when he paddled over the Delaware. He reached the convention, and by his influence and wisdom met promptly, and in an original manner, the clever obstructionists who wished to keep Maryland out of the union.

He discovered who they were, got them to air their ideas slightly in the meeting, had a committee appointed on amending the constitution, had that committee made up exclusively of those opposing the great measure, got them out to frame their objections into resolutions, and then induced the convention, of which he was not even a member, to go right ahead and adopt the constitution as it was. That committee has not reported yet!

Such was the strategy of the open air man—Follow it up and I think your investigations and recollections will indicate pretty clearly that the men you have met and known in private or public life who have been specially efficient in times of stress when initiative and ingenuity were required, were all men who had been trained in character by contact with the clear, cool air of out of doors. I do not expect to find such vigor of mind in anyone who has not had the touch of nature which corresponds with that mythical touch of Antaeus whose strength was doubled each time he struck the ground.

Magnanimity is one of those peculiar graces of character which we covet and which is not found in the hearts of those who have kept themselves tied to the

warming pan and the chimney corner. It was found in every one of the men I have named for resourcefulness. The thing in Abraham Lincoln which raised him in the esteem of all was his largeness of mind. He was superior to envy, resentment, and uncharitable feelings. Take his treatment of Fighting Joe Hooker after that brilliant general had spoken disparagingly of Lincoln and had said that the country needed a dictator in the place of a weak president like Lincoln. President Lincoln had been casting about and experimenting in great anguish of mind to find a man who could forget the rules of scientific warfare and the hampering customs of military procedure and go forward and gain victories which would bring the war to a close.

He was aware of the brilliant military qualities of Hooker and was not in the least embittered by things Hooker had said of him. He wrote him one of the greatest letters ever penned. "I have heard and heard it so as to believe it, that you have said" certain very indiscreet things. "It is not because of these things that I give you command, but in spite of them." "Give us victories, and I will risk the dictatorship." He told plainly how he had been untrue to the general above him at a time when absolute loyalty was demanded, and he warned Hooker that the same thing might be the cause of his own failure. But still, when he thought Hooker the best man available, he gave him command and all the support the government had it in its power to give.

His having been referred to as "the Illinois ape" did not give Lincoln a disposition to refuse to appear in a case with a man who was a truly great lawyer though lacking in certain great qualities. For when Lincoln was asked whether he would consent to consult with that great man he seemed surprised and merely said he doubt-

ed whether that man would willingly consult with him.

His remarkable reprimand of a young officer who had been sentenced to receive reproof from him for quarreling is characteristic not only of Lincoln but of every great man who has been brought to perfection by treatment in the open.

"Quarrel not at all. No man resolved to make the most of himself can spare the time for personal contention. Still less can he afford to take all the consequences, including the vitiating of his temper and the loss of self-control. Yield larger things to which you can show no more than equal right; and yield lesser ones though clearly your own. Better give your path to a dog than be bitten by him in contesting for the right. Even killing the dog would not cure the bite."

In this largeness of mind he was not superior to Washington. The battle of Saratoga had established the revolution. For Burgoyne's surrender congress gave a gold medal to the general who was in command there and was supposed at the time to be entitled to the credit of winning. But Gates was far from deserving. He had deserted Washington in his Trenton attack to go to congress and intrigue for position. And at Saratoga this commander was away in the rear with horses harnessed for flight, leaving Arnold, Schuyler, Lincoln, Herkimer, Stark, and Morgan to do the fighting. They each won part of that victory. Gates knew so little about the battle that he gave Burgoyne terms where a competent officer would have made the entire army prisoners of war.

Gates received the medal, but Washington, though absent, fought the battles of Saratoga. He, as commander-in-chief, wrote the letters and orders, laid the plans which entangled and crippled Burgoyne, sent Morgan's men from his own force, and, most important of all,

kept Howe so busy fighting him in Pennsylvania, and occupied the British at New York so effectually that neither could assist Burgoyne in his extreme need. And yet we hear no murmur from Washington when the glory is given to a dull, cowardly rival.

These valuable qualities of the mind are found in our great men who were reared in such a manner as to bring themselves into close contact with the winds of heaven. The roughness of the winter storm seems to have been the means of setting them in tune for great things, and having overcome by force of physical power the rigors of the elements customarily in their youth and early manhood there was no bitterness in mankind which could provoke them to rancor. With a superiority to all things of the nature of human frailty these men of power and of wisdom have given us a hint that we should rear our own offspring in some such fashion as that which prevailed in the rearing of themselves.

"He that dwelleth in the secret place of the Most High shall abide under the shadow of the Almighty." "He shall tread upon the lion and the adder, the young lion and the dragon shall he trample under feet. Because he hath set his love upon me, therefore will I deliver him. I will set him on high because he hath known my name. He shall call upon me and I will answer him. I will be with him in trouble, and will deliver him and honor him. With long life will I satisfy him and shew him my salvation."

These words are as true today as three thousand years ago. There is as much reason now for wishing our sons to grow into a familiar trust in the Almighty as there was when they were spoken or when Lincoln or Washington was young. May we not so rear our own children that they may be in a measure like that great

commander who poured out his heart to God in the depths of the forest, "For himself dumb, but for his suffering soldiers eloquent?"

May we not hope they may aspire to that high character of faith which was manifested by Lincoln when someone, fearing the president's religious motives, asked him whether he had considered whether the Lord was on our side or not? "No, I have not; but often on my bended knees have I looked up through tears to God and asked him whether I was on his side or not."

It seems to me that these great men could not have been what they were if they had been reared in a hot, dry atmosphere such as we are giving to our children in our schools and at home. I think I see clearly in them a hardness of physique and a nobility of character which are produced only in the open, with God's free air unwarmed coming into rough contact with their strong faces, welcomed by them, and no easier or more favored conditions demanded.

I would not willingly let any child suffer unnecessary hardship, but when I have the opportunity to watch over the progress of little children and find that in fresh air they seem to approach in mind and character those whom we most highly revere, and when those same little children seem to enjoy the very severity which at a distance seems almost too much for them to bear, I am persuaded that there is needed in the life of every man or woman a tempering which comes with exposure under wise precautions to the roughest winds that blow and the lowest temperature the climate can afford.

There is no cold so keen that it cannot be endured with profit by the growing child. There is no danger in facing the cold when properly prepared for it. There comes more vigor to mind and heart in one brief moment

of contest with wintry air than in weeks of softness in the summer's calm.

A study in respiration will show us something of how the cold air of winter acts upon the lining of the breathing tract. In the first place we know that when warm, dry air is admitted to the nostrils it takes moisture from the mucous lining to such an extent that it breaks down the cells of the membrane and produces dryness, cracks, and ulcers. When the air is of a proper degree of humidity these evils are avoided.

Writers on physiology have frequently fallen into the error of supposing that the nostrils warm the air. They do warm the air slghtly, but there is no arrangement in the nostrils for raising air from thirty to one hundred degrees, the increase in temperature shown in air breathed out from the lungs on a cold day. This heating of air is almost a miracle. No one knows just how the lungs perform this herculean task. We simply know that the air may enter the nostrils at ten below zero and come out again in a few seconds, changed chemically to some extent and changed enormously in temperature.

But the wonder is performed in the lungs and not in the nostrils. The lungs are not provided with nerves of feeling to tell us how cold the air is which goes into them. The nose has such nerves. Because of this location of nerves of sense of cold in the nostrils and their absence in the lungs, the impression is given that the air must be warm by the time it reaches the lungs, for we feel it cold in the nostrils and throat but not much at other points.

Now the lining of the breathing tract from the opening of the nostril down to the lung is not provided with facilities for warming the air or giving it any particular change in character. It is merely a tube to conduct the

air to the place of combustion as it used to be considered. The tube feels the cold, but the lung does not to any great extent feel the low temperature of the air. At the spot where any given particle of air gives up some of its oxygen and takes away the carbon dioxide and other impurities from the blood the work of warming that particle of air is performed.

Where it is warmed there it asks for moisture—At that point it is in contact with the blood in the capillaries of the lungs, and blood is largely water. It readily surrenders to the air as much moisture as is needed to restore the balance of nature, and this giving out of water vapor or steam in the lungs is quite as natural a process as is the giving out of carbon dioxide and noxious gases carrying the worn out materials of the body borne to the lungs in the returning blood. It is the venous blood, the foul blood, dark with the sewage and wastage of the body, which comes into contact with the pure air from outside, and it strikes it at the very time the air is raised in temperature so phenomenally.

At this heated point of contact between the outside air and the venous blood the air is warmed and supplied with all the steam it calls for in its raised temperature rise, and it goes on its outward way laden with moisture to the point of saturation.

Now comes the point of great interest to the student of nose and throat diseases, and which explains the beneficial effects of breathing cold air. The nostrils have become chilled by the ingress of cold air. They have contributed slightly of their moisture as the air went in because the air being warmed by them called for a little moisture. But when the air rushes out from the lungs laden with moisture to the point of saturation, perhaps, it comes into contact with the chilled nostrils and the dew

point is reached immediately and dew is deposited all along the breathing tract from the lungs outward, less near the lungs and more near the exit of the nostrils.

By this means the nostrils get in cold weather not only all the moisture they require to moisten the incoming air, but they have a surplus of watery vapor for the purpose of washing down the tract and sending such microbes as are not already killed down into the stomach where they are finished in short order by the juices there.

It is not the taking of moisture from our bodies that is detrimental when we are in dry air, but rather the taking of it from the mucous membrane of the nose and throat where but little moisture is possible, the membrane lying against bone and gristle where there is very little chance of accumulating much fluid at any time. The body does not suffer materially from being in dry air merely by its loss of moisture, for it is four-fifths water in its entire structure, but it suffers seriously when the moisture is taken from its first place of defense against foul air diseases, leaving that place crippled in its work and turning it into a place of rendezvous and accumulation for the very bacilli we ought to be in position to combat.

Breathing cold air is beneficial at all times for those who are not enfeebled by age, for it not only stimulates good circulation and activity generally throughout the system, but the cold air takes moisture from the blood in the lungs where the act of purifying is going on at the time the air is being raised in temperature, and deposits that moisture in the breathing tract where it helps the mucous membrane in its work of washing down the bacilli into the stomach to their destruction.

Close observation of the mucous membrane gives us light on its functions. Under the microscope we find

little eminences topped with cilia, or hair-like wands, which wave about busily and project not only microbes away from the place but also drive on any particles of dust or other impurity which may accumulate on the surface. An examination of the lungs of a person who has died in the city shows them to be dark and heavy, while the lungs of those who spend their lives in the country apart from the dust and grime of the town are much more light in color and texture.

The cilia on the lining help to clear the lungs of such dust as gets into them, although their work is not entirely efficient, for city dust is beyond their powers to remove entirely. Yet they work away as if endowed with intelligence and pass on towards the exits as much of the accumulation of foreign matter as they are able to dislodge and put on its way.

It is quite probable that the cilia do their work much more effectively under the stimulus of cold air than in warm air which is enervating.

It appears, therefore, that the air which does us the most good is that which is taken in as nature sends it, clear, cold, crisp, and invigorating. To deprive ourselves and our children of the stimulating effects of the air of out-doors in winter is a grave error. It is strange that mothers who have positive evidence of the benefits a tiny babe gets from sleeping snugly in his little carriage on the porch in winter weather are at the same time afraid to permit their older children to get as much fresh air out of doors as they desire. It is true children who have been kept in are indiscreet and enjoy the cold so intensely that they get their clothing drenched in snow or storm, but this only proves the truth of the idea that cold air is natural for us and we need it for our health.

CHAPTER XVI.

The Open-Air Room for Little Children.

The open-air room for little children differs from the common schoolroom in several important respects. First, it is without fixed seats. There must be open floor space with plenty of room for extended games. The furniture of the playroom is simpler and less expensive than that of the common room. Plain tables and large kindergarten chairs are satisfactory, but a free use of the floor should always be made, and benches produced by the upper grade boys in the manual training room are better for some purposes than chairs. They are more readily taken out of the way and put back for class use. They stack up better against the wall or on top of tables when you wish much floor space and for sweeping. We use both chairs and benches with common cheap tables, and they all vary in height as much as practicable.

Saw a few inches off the legs of standard tables, measuring the parts cut carefully to be sure the tables so lowered will stand true on the floor and are not too low or too high for the size of the pupils. For very little children there should be standing tables, that is, tables at which they may work in a standing posture. In fact, this is probably true for all children. But we have found that the little ones do much better when a large part of their work is done while on their feet. Bookkeepers often enjoy desks at which they may stand erect for their

work, and there is equal reason for letting children stand at their desks.

An open-air room is not a room with one or two windows slightly open. It is a room with one side of it practically taken out. It is not possible to get children to play naturally in a temperature like that maintained in the ordinary American school. Play in hot, dry air is not play. It is not to be considered. It is simply impossible. Anyone who has observed the difference between the play of children in open-air rooms and that of children in the ordinary schoolroom sees at once that the atmosphere of the common schoolroom is not only preventive of natural play, but deadly in its effects.

I fear the open-air experiment may be tried in some quarters without getting the open-air effects. If the experimenter thinks he is following directions, but leaves out the vital part, his failure to get results will set progress back in his locality in proportion as he is believed in by the people there.

"But, do you permit children to sit in drafts?", is the common query.

We try to train them so they will enjoy a breeze and get no harm from it. This cannot be done at once. Most of us are susceptible to colds if we occupy any part of a room where there is air in motion. It is unnatural to catch cold from a draft unless it is a chilling one and you are sitting in warm air. Cold air rushing in a fine stream into a warm room is deadly, but air in motion is harmless as a rule.

Does the sailor on the ocean avoid drafts? Does the teamster on his high seat catch cold from the draft he is in? No, they dress for the work and expect the drafts. In fact the rigors of cold which they endure without harm are remarkable. But a child well dressed has as

great power of resisting cold as the adult. And we wish every child to get some experience with cold winds. We do not wish him to be exposed to driving storms or to wet weather in the open-air room. But we do wish him to be on such friendly terms with the out-door air that he will not suffer when it blows upon him.

This cannot be brought about at once. But in an incredibly short time after a child has become an occupant of a fresh-air room he is immune to ordinary cold-catching.

With movable furniture and no special place allotted to a child where he must stay, we permit him to be in a part of the room entirely free from drafts until we are confident he is immune to them. In bad weather we do not have the room entirely an open-air one. We have found it entirely practical in zero weather to conduct the work of school without any heat whatever from the heating plant of the school. But while we are getting some children every day who have been out of school or who are not sufficiently clad for such rigor, we do not think it advisable to permit children to work in such air.

The colder the air the more benefit the child receives, and I believe the time will come when the open-air room will be so managed that pupils who prefer to furnish all their own warmth may have an opportunity to do so. That is, we shall have so many open-air rooms that in zero weather we may warm some of them partially, some of them completely, and a few rooms not at all. Then we may permit children who are known by the medical examiner to be able to withstand the cold, and who personally wish to enjoy it, to go into the room that has no heat at all supplied it. A shelter from the blast is all that is really requisite for a well child. With the

shelter, plenty of proper clothing, and an opportunity to take free exercise in stirring games along with his educational work, he will thrive better in cold weather than in any other. Possibly a zero temperature is best. The results we have secured seem to indicate that the lowest temperature obtainable is best for the well child.

White men have accustomed themselves to the cold of the Arctic regions so that when on a polar expedition they came to any structure where there was a fire they refused to enter, but preferred to stay out in the open air where they felt better. One such did his sleeping in his ordinary clothing, declining to use the sleeping bag. When the sledges were moving over the ice or snow and the men riding, he would lie down and go to sleep without adding a blanket to his ordinary clothing, being warm enough whether asleep or awake so long as he had access to the free air of out-of-doors.

The open-air room should be kept as cold as compatible with comfort for all. This is a lower degree of temperature than would seem advisable to one not accustomed to seeing children playing in cold air. The fact is, cold air is a great blessing to races occupying territory where cold prevails part of the year. It is the secret of success of northern races in overcoming southern ones in this hemisphere. Judging from historical accounts, the race accustomed to breathing the more vital air of a cold climate, other things being equal, possesses more vigor and initiative than the race bred in a warm climate.

We have read of the decline of Rome as being due largely to the enervating effects of the warm bath; but the warm bath does not destroy vitality as completely as does the hot, dry air of the common schoolroom in the northern part of the United States. We have "improved"

our systems of ventilation until it is the common boast of engineers of public schools that there is delivered to every classroom a sufficient quantity of air at a proper temperature to insure perfect sanitation.

No greater mistake can be made than thinking that hot, dry air blown vigorously into a schoolroom where children are sitting is good for them. In the first place, it does not reach all alike. The common school ventilation works for the purpose of getting a quantity of air into the room within a certain time. It cuts a tunnel through the poisonous air of the room and makes a draft there, while most of the air there is unchanged or merely turned over gently.

Because the air from outside the building must be raised in temperature sometimes sixty or seventy degrees and no provision is made for the required humidity that should be present in order to make the schoolroom tolerable, we are promoting weakness, catarrh, and all foul air diseases by supplying air drier than that of any desert—air that is fatal to plant and animal life when long exposed to it—air that eagerly seizes upon every particle of dust available to fill partially the steam vacuum that has been created by this rise of temperature, and these dust particles are fit vehicles for carrying to the breathing apparatus of pupils all the germs that may be gathered up for this entry into the very place from which we ought to try to exclude them—air that causes such rapid evaporation of moisture from the mucous membrane of the breathing tract, the eyes, the ears, and the seats of smell and taste, as to destroy the senses and provoke the diseases incident to exposure to desert conditions.

Now play under such conditions is not play at all. It is as well not to attempt it unless the room may be

made right for it or the play may be had out of doors entirely.

Our open-air rooms are for the lower grades at present. There are two main reasons for this. The first one is that there is a higher mortality rate among the younger children. They are so susceptible to disease that we call many of the diseases which they take at that time children's diseases. I doubt whether there is a children's disease that is contagious. I suspect that all these diseases are called children's diseases merely because it is only children that have the low powers of resistance which these diseases require in order to get in their deadly work. Since measles are more deadly to the adult red Indian than to the white child, the reason for its fatality must lie in the relative susceptibility of these patients to this so-called children's disease.

The other reason why we use open-air rooms for the low grades only at present is because there is not so much apparatus required in the low grades and we may dispense with the fixed desks and get a room for exercise.

We began with two open-air rooms. Those were both first grade rooms. They received about half the pupils of that grade entering our school in September, 1909. After the patrons of the school saw the good we were doing the children in those two rooms, especially the parents having children in both the ordinary and the open-air rooms, we received many requests for such treatment in upper grades so the older children might have the benefit of it.

Especially one eighth grade room that petitioned for open-air treatment, we found it difficult to refuse, for it contained several boys and girls who very much needed it. But because of the requirements of the course of study, with its drawing, writing, manipulation of various

materials and many books, including reference works, we knew it would be necessary to retain the fixed desks and there was no adequate place for the exercise which belongs with cold air school work.

So we extended the work into one second grade room and into the kindergarten, taking the fixed desks out of the second grade room. The course of study in the kindergarten does not require much change in order to carry on open-air work. The first grade course we have changed almost entirely. That will require a separate chapter. The second grade, thus far, we have not materially changed because the children have begun their schooling in the old dull manner and it would probably be too much of a transition to put them into work similar to that pursued from the first in the first grade rooms where beginners find out how to read without being taught.

The general directions now given the teacher of second grade pupils is to follow the course as to the subjects and their order, but to cut down the time allotted for study and reviews, reserving much more time for fitting the children up physically than the course contemplates. The same general directions are also given the fourth and third grades in the new rooms the board of education has constructed for us on a roof which is about level with the first floor of the building.

So we put open-air into the lower grades, not because it is not as good for those in the upper grades, but because we are merely beginning to put this work into operation and the present requirements in the upper grades call for so much cumbersome school furniture and impeding apparatus that it is not practicable to make open-air play rooms in a public school above the fourth grade unless there is also a suitable play ground or an

open-air gymnasium to be used freely by all upper grade classes at all times in the day.

We confined our efforts at first to the line of least resistance and that, in the ordinary public school lies in the lower grades. If I had authority to build the equipment for an ideal school for children of all ages and grades I should be happy to supply all with plenty of free play in cold air and make the bulk of their work suited to cold air and practical out-door treatment. But I am simply reporting what is being done in a public school where we are not violating the rules very seriously and are not scandalizing specially those conservatives in culture who come with wide eyes to see what the trouble is in the school which has so broken loose from traditions.

Consent of parents and children is essential to success. In every intelligent community, I judge from experience, about fifty per cent of the patrons of the school are now ready for this work. There are others who cannot stand a draft, who cannot step outside their hot, dry houses without danger, who look upon cold as an enemy of the race, and who cannot bear to think of subjecting their children to rigorous conditions.

We have no right to disturb such persons in their deeply rooted opinions regarding their own constitutions and those of their children. They should merely be regarded as ill and perhaps slightly unsound in judgment for a time until their own children begin to see the difference in color, in rigor, in strength of muscle, in powers of the mind, and in general cheerfulness. After a time these young persons will break away from the confinement enjoined by their parents and may escape for their lives into the fresh-air rooms, with but a partial consent from their elders.

EXHALING.

INHALING.

We have been so careful at the Graham school that we have asked for specific written directions from all parents in regard to their first grade children, whether they should be given fresh air or the ordinary school temperature and air.

In the course of our experimenting we made a few errors and lost support by some of them. But in every case where a parent wished his children placed in a warm room we have had a sufficient waiting list in the warm rooms wishing to get into the cool ones so there was no embarrassment in making the change.

Our errors are instructive and interesting—One of these is not readily understood, so I will speak of that first. In placing a child in out-door air there is very little danger of any bad results, no matter what the weather or the style of dressing the child. But when the air of the room is mixed there is some danger. At first we gave the rooms no heat at all. Beginning in the mild weather of September, no heat was required for some weeks. Gradually going down into the cold weather in this way with all pupils in the two rooms gaining in powers of resistance to cold as well as to disease, we found the little people did not confess to being cold at any time, whether they were warmly clad or not.

But after the holiday season, when the children had been coddled at home and overfed with dainties, I feared the consequences of permitting the children to return to rooms as cold as those they had been delighted with in December. January began very cold, and so we gave the two rooms a gentle supply of warmed air. That air came from outside, was warmed in the ordinary manner by passing through the steam coils into our "tempered air" chamber, and from there was forced into the open-air rooms, the windows being open at the time,

though not as widely open as we had had them in less severe weather.

The air so tempered by being brought from near zero to about 60 was made extremely dry. It had the peculiar property of radiating heat rapidly from any warm object, the human body as well as other things. And so it was a peculiarly icy feeling draft, although at 60 degrees, to strike against the bodies of these hardy little children.

Dry air is a rapid conductor of heat, and so the children were made chilly by that warmed air when they would not complain of the direct air from the windows. The children themselves did not know the difference between the current from the tempered air chamber and the draft from the window, but the ordinary observer would readily fall into the same error as that into which I fell in the matter and suppose that the children were being assisted in keeping warm by that tempered air.

But the reverse we afterwards found to be true. The tempered air at 60 degrees Fahrenheit was more chilling to the body than the air from outside with its natural humidity, even when the outside temperature was below the freezing point. It is difficult to see how freezing air is not as cold to the body as air at sixty with its humidity very low. But whoever would become intelligent regarding warming and ventilation should learn that dry air is chilly at 90 degrees sometimes. Zero air is not always as severely cold as we expect to feel it. Air with the right humidity in it rarely causes one to catch cold or even to feel specially chilly. But air robbed of its humidity, or expanded so it is at a low percentage of saturation, which is the same thing, is sure to feel chilly, and to a person of low vitality it is quite severe.

Too much clothing in the open-air rooms is another mistake—Parents who are most enthusiastic over the

cold-air rooms are liable to think their children must have new and thicker underwear and a large supply of woolen in their other garments.

The best underclothing is not thick wool. A child is in danger when his skin is wet and his underwear saturated. It is right to sweat profusely at times, but it is not right to perspire freely and sit about in either a warm room or a cold one with clothing full of moisture. My family physician is a young man of great skill and success. He tells me that the difference between his summer and winter underwear is that the winter underwear has sleeves. It is of the light balbriggan kind which is very inexpensive and not heavy enough to hold much perspiration. When he uses his open car in severe weather he does not change his underwear to prepare for the ride, but wears a heavy overcoat which keeps him comfortable.

We should learn that there is no need of heavy underwear in the houses, offices, and railway and traction cars where most of our time must be spent. By having a sufficiency of outer wraps to use when the exposure is to be severe we live much better with very little clothing about us to hamper our movements and to prevent the circulation of blood.

A dry skin is safe at all times—It is not sanitary to go about with clothing saturated with perspiration. By using only such an amount of clothing as permits free circulation of the blood, lively activity of the skin, and some resistance to cold in the natural way we may not only prolong our lives but at the same time increase our efficiency.

Our work is usually done much as we feel. In vigorous health and with a determination to accomplish great things we are able to perform a valuable day's work with-

out much fatigue. But the impediments of such clothing as is found on many who unnecessarily take to the sick room it is impossible to accomplish much more than keeping up the fight against adverse physical conditions and managing to live.

I once found a boy in school who required discipline. His teacher sent to me for help as he had directly refused to obey her. The trouble was that he persisted in sitting in school with his coat tightly buttoned up and a pin used at the neck to make it more snug. She had asked him to unbutton the coat and he had refused.

Telling him I feared he might take cold if he kept himself so warm in the close schoolroom, I asked him to unbutton the coat and so make a difference between his dress while in the warm room and when out of doors. As he was slow to comply, I pulled the pin and loosed the buttons rather quickly but gently. I found that the coat was the only garment covering his body. He had neither shirt nor undershirt, no waist, and no overcoat.

Apologizing for my officiousness in the matter, I told him that since he was not wearing anything else there was no objection to his keeping the coat buttoned. I had supposed that he had more on or I should not have interfered with his dress. And I assured him that there was little danger of his being too warm in school with matters arranged as he had them at first.

Of course, I got him what I considered proper clothing, but I have often thought since of that boy with but one garment covering his trunk, coming to school and doing the ordinary work in severe winter weather which a poor boy has to do, and I have doubted whether he was really so much worse off than some of his neighbors who were swathed to suffocation in many garments. At any rate, he did not seem to be suffering from colds or the

weather at any time, the natural resistance of his body being sufficient to keep him probably more comfortable before we got him the new clothing than afterwards. We rather overdid the matter and got things for him which were "good and warm."

We prevented further humiliation and advertisement of the poverty of the family by his lack of a shirt in winter, but from what I have seen of him and others since, I doubt whether we really benefited him very largely by passing him from his simple one-garment warmth to that of the child who is suffocating with wool.

Now, I am not advocating one garment as being sufficient for winter, but merely drawing a contrast between the condition of the boy who had not what society considers enough to keep him warm and the child who has what many a fond mother feels is essential to the welfare of her child and what in reality militates against health and growth and well as against mental development.

The clothing ordinarily worn by pupils in cold weather is usually a great hindrance to their progress, and it is dangerous to take any of it away from them. But if this experiment of teaching in the open air is to become a widely extended one it will be necessary to make it plain to mothers that the clothing which the child comes to school in when there is a warm home at one end of the journey and a warm school at the other is a little too heavy for use in the cold-air schoolroom with its activities.

Much of the benefit to the child in the cold-air room comes from his having an opportunity to resist the cold with his own natural warmth of body. We wish him to warm himself as earnestly as we wish him to digest

his own food. There is no sense in giving him predigested food if he is well, and there is as little sense in keeping him from making a large part of the heat which his body is to enjoy.

The heat which wool supplies a growing child weakens it, as a rule. The heat furnished by the natural heat-producing functions of the blood gives strength. We know that the hothouse plant is unable to withstand the balmy air of spring, and so we introduce it to the open-air very gradually and cautiously.

We wish lettuce to be tender and delicate. But we wish our children to be vigorous and strong. The open-air school produces the vital energy we wish to see acquired. The warm school dissipates it.

The kindergarten is under fire from a new quarter. It is claimed by some medical men that the child at kindergarten age is possessed of such low powers of resistance to diseases that he catches almost every contagion to which he is exposed. Children who reach the age of six or seven without taking any of the children's diseases often go through life without them, but children who are exposed to all these diseases by assembling in kindergartens and Sunday schools with many others of like age succumb to several dreaded and truly harmful diseases which they might escape if they were not allowed to become infected.

Now this objection is one which has to be met, and it often happens that the answer is not such as convinces the objector. We think we have in the Graham school an answer which ought to satisfy every reasoning individual who admits that children of mothers who have to work or who are much pressed with various duties ought to attend the kindergarten.

We have found it entirely practical to raise the resist-

ance of little children so that it seems to equal that of children who have passed beyond the kindergarten age. It is too early to show data in proof of this assumption, but from present indications we seem to have removed that objection to kindergartens, for the children of our fresh air kindergarten are sufficiently robust and full of vitality to resist anything that their older brothers and sisters are able to resist.

Open air rooms were established at the Graham school, not for the purpose of treating any special class of children. Particularly does the work differ from that in institutions where only tubercular children are received.

Having observed the effects of fresh air on a group of tubercular children which I supervised during the summer of 1909, I determined to try some of the effects on the children of ordinary conditions in life and see if we could not get them to the intellectual point where once telling is worth something.

The ordinary kindergarten is a stuffy place where the temperature is frequently above seventy degrees Fahrenheit. Every student of hygiene knows that this is ruinous to the constitution of the child or the adult. Yet because in a hot, dry room the teacher often feels chilly more heat is turned on than the rules of the board of education will permit, and then some more is usually given because the teacher or kindergartner feels she is not getting quite enough. She judges by her personal feelings and thinks the thermometer is telling an untruth when it records something over seventy and she feels chilly.

Calling the thermometer unreliable is the common answer given by the one who asks for more heat when the room is already far too warm for health.

Our work is designed specially for those who are well and able to exercise. There are, of course, some children among them—the usual number in any public school—who are inclined to be tuberculous, but they mingle with the rest on equal terms, not being far enough along to infect others. Such children recover surely and speedily under the treatment given.

Open air work is for the purpose of making the children fit for instruction rather than for direct purposes of instruction. We have varied the work, both in the first grade and in the kindergarten so the teacher is asked not to teach at all. If the children find out some things which they wish to learn, that is fortunate. But there is to be no direct intention to instruct at all and the pupil will not be required to show any results whatever when he has been a year or two in the school.

Results are secured, as a matter of fact, much beyond our first expectations. But we hope it may never be judged by results—I mean intellectual results.

If a child can find out for himself in the kindergarten most of the things which he is supposed to know after attending a given term of months, and do this without being directly instructed or called upon to do specific acts of learning, we are satisfied. In fact we are more than satisfied if he can get the benefits of this sort of training without learning anything whatever, for we know that with his taste for acquiring and his increased desire for knowledge, he will pass all others who have been made stupid by months of kiln drying in the ordinary school or kindergarten.

I have asked the kindergartners not to teach, not to direct with the psychological intent of developing faculties, not to do the very things for which the kindergarten was once supposed to exist. I am aware that the social,

rhythmic, intellectual, and moral sides of the child will be strengthened even if we try to avoid it when such health-giving treatment is afforded. But our aim is to make the child well, strong, happy, self-reliant, and able to resist disease in any form that may present itself.

So we open the windows, winter and summer. We permit the children to wear their street wraps, but we look to it that they do not bundle up too much. Our aim is to keep the body of the child dry. The child who is perspiring profusely is in danger. He needs special care wherever he is. If we can keep the skin normally dry—that is, keep the clothing from being soggy with perspiration—we think we have done the right thing for the protection of the child for the time.

If the parents know the kindergarten is an open air one they will first procure for their children an abundance of clothes. The little tots will come to us swathed in flannels and furs. This is just what we do not desire. We wish to receive them with as little clothing as is possible considering the weather outside. The clothing which will bring them safely to us on a bad winter day is too much for their use while in the open-air kindergarten.

With too much clothing the child becomes too warm, gets damp with perspiration, and soon catches cold. So it is our first aim to see that no child is overclothed.

Supplying warmth for its own purposes is one of the prerogatives of the body. It is as wise to feed a child exclusively on predigested foods as to give him at all times air and clothing so warm that he does not need to produce any heat.

To show that this is natural to the child, let him have his choice as to what he will do and what he will wear. You will soon see that he is averse to heat. He wishes

to get out and revel in the snow and the storm. This is not because he is perverse. It is because his hot little body was intended by a wise Creator to resist the elements to some extent. The fig leaf was not chosen for warmth.

Mothers ordinarily exclaim when children get into a draft or run out without wraps, or go with less than an abundance of clothing when the weather has in it any of that peculiarly life giving cold which the child longs to feel. Suppose you never let your child lift. Suppose you never let him stand on his feet for fear of making him bowlegged. Suppose you never let him chew his food for fear he may injure the gums or the baby teeth. The folly of this is evident at a glance.

But the folly of keeping a child toasty hot all the time is fully as culpable as any of the others supposed here.

A child has a right to activity and to coolness—If he is to have any strength as a man he must exercise his powers of resistance against the weather of the locality where he grows up. If he grows up in a very mild climate he will not have much strength. If he grows up in a rigorous climate and has a chance to resist it he will become a vigorous man.

I am considering, of course, children belonging to races inhabiting the temperate zones.

The ordinary kindergarten child is coddled too much. Most of the trouble with him when he is out of sorts in the exercises arises from his protest, ineffectively expressed and ignorantly made, against the unnatural order of things which he does not understand.

And so we are managing a kindergarten here with the intention of developing strong, kindly, graceful, healthful children.

CHAPTER XVII.

The Open-Air School a Play School.

The open-air room may be called a play room, but it is so easy to mistake the meaning of plain language that I wish to make this very simple. There is play in every schoolroom. There should be work in every play room. But we think of the open-air room, or the fitting-up room as a play room because there is so much play in it and because the work done is so easy that it is a part of the play. The matter of learning is incidental. But one should not imagine that there is less learning in the play room than in the regular room. There is much more learning in the play room than in the regular room, but there is nothing like the hard study work of trying to review things imperfectly learned that obtains in the old form of school.

The play room is conducted solely with a view to fitting the child to learn, and not for the purpose of teaching him anything. We find that children in proper air have a natural pressure of desire to learn. We permit them to learn, but we do not by any means compel or urge them to learn.

To fit a child physically to wish to learn is our great end. I have pointedly and repeatedly instructed my teachers in the open-air grades not to teach the children anything. I have asked all the teachers in open-air rooms not to do anything at any time when they do not

feel like doing it. They must wish to do the thing or I do not wish them to undertake it.

The children are not to be given anything to do which they do not undertake with avidity. I do not mean to say that a child should do as he pleases. But I do say that he should be so fitted physically that he will please to do the thing which is right and natural and educative. There is a great deal of difference between telling the weary he need not do a certain thing he does not wish to do and fitting him to wish to do that very thing. We are not judging of our success by what we get out of him but by his attitude towards the thing proposed.

Think of the difference between the mind of the weary child, nose stuffed full of foul matter, head swimming, eyes bleared, ears inclined to ache, other senses dulled, bones aching with confinement in hot, dry air, and the mind of a child who is fresh as a daisy, full of kindly activity, curious to know, satisfied with good things, and so full of resistance that he can walk into the contagious ward of a hospital and come out victorious or enter upon vigorous play or work without any signs of fatigue.

Do not mistake me as advocating play in an ordinary hot, dry room as capable of fitting a child up to this stage of physical perfection. That is impossible. Do not try it. But I do advocate the use of a proper hygienic schoolroom where God's pure air is given directly to the lungs of little children, where the impulses of life need not be smothered, where joy, freedom, and kindness are their constant possessions, and where they are not fooled into thinking they can learn and then shown how impossible it is under the circumstances.

The wonder in our educational work is not that many children are retarded in the grades. The wonder is that any of them at all get through the course even with the

shams of knowing which are common to our graduates.

Would you think it charlatanry in me if I should say that I know how to multiply the mental ability of your child by six? If so, I will make another statement which you can perhaps accept. I know a treatment for your child which will cut down his mental efficiency to one-tenth of what it should be, making his course in school at least ten times as difficult as it ought to be. That treatment is the kind that is regularly given in the school where the temperature is above seventy and the air dry as Sahara or drier.

How to teach a play room is a separate art from the work done in our normal schools. It is so different that I am tempted to declare to you, although I know it will simply be a premature announcement and will make me enemies among the orthodox, that I prefer to have no teachers at all in my play rooms for little children. I do not wish to put their minds under the care of women who have had the resiliency taken out of them by sitting on wooden benches studying the things of psychology, philosophy, methods, and theories as presented in normal schools.

If I had my way in this matter I should merely choose big sisters for these little people. Instead of calling them teachers I should denominate them showers-how, or something of the kind. I should permit them to use the things of school but sparingly, with the expectation that most of what is now taught with much skill and labor in the grades will be gathered intuitively by the children without any formal instruction.

It will require a separate chapter to consider our method of teaching children indirectly and through games. But I wish to state here that we are getting children to know a great deal without any formal teaching.

They catch the ideas as they learn the names of their playmates. In our first grade reading there are no mistakes made. The child reads perfectly the first time he tries it in school, and he makes no blunders during the first year of his school life.

The ordinary child comes to school with a consuming desire to learn to read. After he has been in the routine of the school awhile under ordinary conditions, unless he is a wonder, he finds he is forgetting much faster than he is learning. It is only by an immense amount of review work that he is able to get up a few hundred words in the course of a year. He feels the dullness that comes from confinement in hot, dry air. He sees the road to learning to read such a long one that no child in the whole school has passed entirely over it. He becomes depressed not only with the length of the course, but also with his own particular dullness. As a result he loses his good opinion of himself. He drops into the formal routine of the school, and the fine ability he brought to it at the opening of the year gets so blunted and obscured with hard work without much result that he becomes easily a dullard.

That sort of work is not education. There ought to be another name for it. But the work done in the play room where fresh air and good health raise his resistance to disease and fatigue to normal does a great thing for him intellectually. It fits him to learn so that no skill is required in the showers-how. Instead of being formally and definitely taught, he learns by absorption and accident. What he learns he has the ability to retain. What he learns he learns solely because he wishes at the time to know it. That he remembers. What he learns he gets like lightning, and when he wishes afterwards to use it, he does not have to scratch his head a

long time to try to remember it. It lies in his mind in shape for instant use.

The ordinary school makes dullards and destroys life. The open-air play schoolroom makes brilliant scholars and preserves life. The words, "I am come that ye might have life, and that ye might have it more abundantly," might well have been said in a different sense concerning the coming of the idea of teaching children in the open air and giving them the vitality which is the result of resisting natural cold in naturally humid air.

The kind of play which children in an open-air room should indulge in is not meaningless jumping about merely to throw off animal spirits, but is carefully calculated to be of the various sorts which will accomplish the ends of the school.

Let us first consider the mere animal sport which is necessary to fit the child to desire knowledge and to develop his muscles. It is the same kind of play that is useful to keep up his powers of resistance to disease and to the cold air of the room. He must exercise. Every warm-blooded animal requires a great deal of muscular activity while growing and this is one of the great defects of the ordinary school, it does not provide for such sport.

The animation aroused by a good game has a great effect on the growth and intelligence of the child. Note the intensity with which young animals of all kinds play. They go through antics which have some resemblance to the acts of the mature beast. Children similarly enjoy very much the sort of game which gives them parts resembling the parts played by adults in the game of life.

But because the child does things which resemble the acts of savages in ages long since gone by there is little reason for the notion which has acquired a footing in some high places that the child in growing passes through

all the stages experienced by man in historic and prehistoric times. That is a mere assumption without foundation, and it is a waste of time to try to afford children modes of expression for all the barbarous customs which their ancestors indulged in and which it is falsely assumed that the child experiences either in desire or in fact.

He is no such a brute. Some of the things he does which have been pointed out as resembling the acts of the cave man or the lake dweller are merely natural acts of a being possessed of hands, arms, and legs and a desire to use them. He does not really hark back many centuries. But he does enjoy the thrill that comes along with doing something similar to the things done by the adults he knows intimately. So the play of children in which one is father, another mother, another the dog, the cat, and so on, one the policeman, one the wolf, one the milkman, one the teacher, and another the naughty pupil, goes to show what manner of activities excite children of different ages and call out that action which goes along with the pleasurable thrill of doing what the grown people do. So we encourage and invent means of gratifying the children in this way, knowing that the form of the play is immaterial so long as there is play.

Giving half the time of the school session to development of the physical powers may seem extravagant to the educator who looks merely at the surface of things in the light of what is being done at present in our schools, but during the first four years of a child's attendance at school there is a greater need for just this work than for any other. If we may build him up in physical vigor so that when he arrives at the age of ten or eleven years he will be much more robust than he would be under the present methods it will be a great gain for him in all his after years, for the battle of life must be fought

out with the physical powers rather than with the mental. The powers of endurance are more to be relied upon than mental acuteness, especially when we consider that endurance includes the disposition to work and the ability and inclination to persist in the face of difficulties.

Our old ideas of the studious child as the model one should take a modification in the light of the fact that many a studious child is studious merely because he is obedient and he is obedient merely because he is too weak to resist with his own ideas those of the adults who have him in charge, and so he plods feebly along the road to learning, being directed into it by his elders, studying diligently because he is commanded so to do, and getting very little out of it except the mechanical or formal husks of ideas which are not vital enough for any future use except for teaching purposes where the same process is to be repeated in another generation.

His studious habits often break down his health. He does not care to run and play in the open, because he has been brought up to believe that poring over the book will make him commendable. He prefers to be commendable to anything else, because commendation keeps from receiving the treatment which so grates on his nerves when he finds himself at outs with those who are bringing him up to scholarly attainment.

Like the monkey he will hold the book continually before him while it pleases his master or mistress, and like the parrot he will recite off words which have meaning to adults but slender meaning to him. With this monkey and parrot sort of activity he retains enough of the formal things of instruction to make an excellent showing in the reports of the school and for family exhibition purposes. He may become a wonder to the circle

of admiring friends who do not know how shallow is his attainment and at what a sacrifice it is obtained.

But the price paid for this early cramming for applause rather than acquisition from a living desire to know is often paid in later years when the conditions of life require initiative, enthusiasm, resourcefulness, pertinacity, and animal vigor. We often see the so-called brightest students of the schools falling behind their dull mates in the real battle of life and we wonder how it can possibly come about that the ones who gave us the greatest promise in their youth lose all the large prizes and those whom we regarded as undutiful, incapable of plodding in school, and not specially scholarly in their taste are the ones to win the victories and be of real use in the world, not only to their families and to themselves but to the state at large.

It is better to be the dunce in school for a few years while growing than to cripple one's efficiency by inactivity and study of the teacher's wishes so as to be unable to think or act independently and vigorously when the time for such action comes and it is important that such thought and action be had.

My purpose is not to deprecate good work in school, but merely to show that it has been too highly regarded and sought after at too great expense of vitality and originality. I wish to see if we may not find a way of dealing with children and youth which will prevent the loss to the world of efficiency and distinction in many children who are now getting the highest praise for doing what most persons believe will make them great and good.

Does it not stand to reason that the child who spends his time in such a manner that his cheeks are habitually red and his eye bright is being better prepared for life

than if he spends his time with dull eye and fading color? What is the effect on the future of the child who enters school at the age of six knowing that seven and three are ten, knowing it from experience had out of doors in free play, but who spends two years in being "taught" and then has to take time to tell you somewhat uncertainly what he hopes is correct as to the sum of seven and three? What has been done to him during those months of "teaching?" We all know of cases in which the child of six or seven has become dull and slow in regard to facts which he knew without stopping to think before he got the training of the school.

The uncertainty of school results, the fashion of guessing and getting conclusions by use of feeble and half-awakened brain powers, the dawdling over things which might be done instanter, all go to make the coming efficiency a minus quantity.

Fresh, cold air awakens—It sets the blood tingling in the veins. It creates gladness and spontaneity. It causes the peripheral circulation of the blood to go forward briskly. That circulation is near the skin and when it goes forward rapidly life is abundant and health secure, but when it is kept sluggish by coddling and housing in warm quarters, bundling up in furs and flannels, and keping the body "in order" as they call it in school, then the forces of life are dammed. The currents which go to make the building of a healthy body are made sluggish. The repair of used-up tissues, the restoration of vigor after effort, and the resistance of disease are all put out of commission, and the child but partly lives.

The warm room deadens—The child naturally hates it. He cries to get out where nature can assist him in his needs. Education in a warm room is criminal. To tie

down the wings of birds that are expected to fly does not tend to rapidity or continuance in aviation. To cause ounces of blood to circulate when nature calls for pounds of it is not conducive to long life or a useful career.

Things that are learned so as to be forgotten easily are not properly acquired. It does more harm than good to instruct in that manner. Only that instruction which is vital is best. That which the child receives with avidity is what we desire for him. What he does under the mesmeric influences of the powerful teacher merely trains him to get under the mesmeric power of some other person who has ulterior motives and will use them to his hurt. What he does merely to please his parents and teachers is of doubtful value as education.

What he learns by one contact and remembers always is much better. We are accustomed to thinking that children cannot do this sort of learning. But my experiences with children in the open air where there is plenty of activity and freedom and where the opportunity for learning is given instead of formal instruction convinces me that the great subject of education has been but feebly investigated in the past. May I urge doubters to try a few children in open air for a few days and see what a revelation of mental vigor it will afford? Try them where it is cold, not merely cool.

CHAPTER XVIII.

Drafts in Large Buildings.

A very difficult question has arisen lately as to how to ventilate and warm large concerns when the plant requires an abundance of fresh air, proper temperature, and sufficient light for certain forms of work. Observation of the results obtained in some of the most expensive and supposedly best systems convinces me that there is much money wasted and the outcome of the matter is that the employes suffer more intensely than engineers and owners are willing to admit.

Imagination is given as the cause of much of the trouble. It happens in every such large building that there are those who complain bitterly of the drafts of air that strike upon them, and those in charge spend their time getting about and seeing that things are adjusted in a scientific manner, but when they have done their best to help out the afflicted ones, they decide that there can be no serious draft in any part of the house and say the imagination of the man or woman who makes the complaint is to blame for it all.

Recently I stood within range of a number of employes in a large office and looked at the clothing worn by the men and women employed there. There were many men with coats off and without hats. Other men wore both. One old gentleman disliked to wear his hat, but declared he should have been in his grave long

ago had he not taken the trouble to cover his head when in the office.

A young lady was pointed out to me as one who had complained of a draft which no man could find. She was in a part of the office where there was no intake of air near, the openings in that part of the room having been stopped to prevent any breath of air from falling in the neighborhood. They had been good to her and had done all they could to make sure there was no sign of a draft there, and thought it must be her imagination which was working the mischief, for she still insisted that she felt a draft after all this had been done. It seemed she must be a very ungrateful young woman to complain after all that work had been done to relieve her.

Without her knowledge of my purpose, I took a place not far from her desk with some apparent work which permitted me to remain there a short time without attracting attention. This matter of ventilation has become one of so much soreness that it is dangerous for the manager of an office to invite any expression of opinion from any of the force, for he is convinced that there are no two of them who feel alike and it is impossible to satisfy them all. For the sake of the peace of mind of managers generally I will admit that with dry air the thing is impossible, but for their information I will say that with properly humidified air it is possible to satisfy the demands of all in any office provided the windows are properly secured and the fan power adequate and not too strong.

She was dressed warmly. Over her dress was a thick sweater which did not come around in front, but was worn merely to protect her back. Her ears were filled

with cotton. This struck me at a glance. I have never known a handsome young woman of fine face and figure, with her hair done in so stylish a shape as this young lady had applied to hers—and with such uncommon attractiveness, who would put cotton into her ears in large pieces, visible at ten yards distance, merely because of her imagination. I was convinced that this young woman was neither imagining nor shamming. I was convinced by the cotton that she was in earnest and that she was really suffering from draft.

Changing my position slightly I got where I felt a distinct draft on the unadorned part of my cranium. Standing there for a few minutes I was joined by the gentleman who had suspected her of poetic powers regarding the atmosphere.

"I feel it, myself," he exclaimed to me in a stage whisper.

"You are right, there is a strong draft here, and it is pretty continuous. The young lady has just cause for complaint. But it does not come from the stopped up places which you have regulated for her comfort. It is part of the general whirl of air which in this large place is induced by the steady flow of air in distant parts of the room."

Following its direction towards the source, we soon arrived at a downpour of air which would send a strong man to the grave if he persisted in sitting under it for a few hours. It was in an aisle where nobody had to suffer it, and in passing through it, few cared to complain or even think of it.

Another draft was complained of in a few minutes as I stood with the engineer down by the source of all things, the great fans.

"Go back," said the engineer, "and find out what the temperature is at that desk."

The boy returned in a few minutes and said, "It is seventy-one, sir."

The engineer looked at me as much as to say, "See what lunatics I have to contend with in this business!" But he did not say it, he merely looked it.

As I was there to help, I said, "I wish to go to this desk and see what I can find out."

I proceeded to that floor and got an introduction to the man who had sent down the unreasonable complaint that he was in a draft when the temperature on the thermometer right by him was seventy-one.

"I am looking into ventilation conditions here, and was in the engine room when your message came in."

"The engineer did not get my meaning. I said we are in a draft. We are in a dangerous draft. The temperature is all right, but the draft is here and we are suffering. There are a dozen of us here, all suffering from that draft. I am the one doing the talking, but there are others who get the draft worse than I do."

It was quite true. On the way to the gentleman I remarked that I was going to see him about the draft. The official to whom I spoke said he did not envy me my job of interviewing that man on the subject. This clearly indicated that the man was a crank and that most of the people in the house knew him for one, and there was no use in trying to satisfy such as he.

That draft was truly dangerous—It was not too cold. In fact, it was too warm a current of air. But it was making people ill, and it is surprising, not that so many were ill from it, but that so few really died from the injurious effects of it. Its deadly nature arose from two causes, either of which was enough to condemn the

system and justify any of the employes for resigning. The draft was far stronger than there was any reason for, and it was a dry stream of air. He might have been strong enough to endure the current of air if it had been at seventy and humid, or he might have stood it at seventy dry if there had not been such a rush of it. But the two not only made all who had to withstand it chilly, it also made them temporarily slightly insane. There is nothing more likely to unbalance the mind than a stream of hot, dry air. The wind of the desert produces insanity, especially when there is something to worry about and the mind is occupied unpleasantly.

But when I had looked the situation over and said there was far too much current of air in that part of the office and that the temperature did not require raising, he found I was the same sort of lunatic as himself, for I was the only one, not sitting in that wind, who had acknowledged to him that there was too much wind there.

"I am to blame for part of this, sir, and I shall try to correct it. I shut off yesterday several large ducts on the fourth floor, and the result is a stiffening of the breeze where you are located. It will take some time to remedy the error, but I shall see that it is done. You are entirely correct in your complaint, and I am partly to blame for strengthening the breeze yesterday."

"It was yesterday that I noticed the increased strength of the draft, but I never expected to find anyone who could tell me what caused it. I merely knew that it was there, and I knew when it arrived in greater force. I shall be glad to suffer for awhile if you are about to do away with this great difficulty permanently."

I explained that it would take four men all night to reset the pulleys on the dynamo—we might not be able

to get them to work at it that night—but I should ask to have it done as soon as the men could be detailed to the work. And I left the unreasonable man believing in my heart that he was one of the most rational and long suffering men I had ever known, for how he could live in that draft and not mention it vigorously I cannot understand. With men and women about him, all working at a high pitch of strenuosity for the good of the company, and he being the only one likely to be heard in the matter of a complaint about the ventilation in a large system which had been declared perfect by many experts who were paid by the company which put in the system as all perfect, I could not see how the man had contained his patience as well as he actually had done.

The amount of air delivered by a ventilating system is usually too great. It is based on the assumption that carbon dioxide must be kept down to six parts in 1,000 of atmosphere. This means a tremendous power in the fans and a great rushing of air in front of them. It means that all the intakes in the building must be shielded in some manner to prevent too direct currents.

Now that we have found out that carbon dioxide is not the enemy we have to fight, we may rest a little on the proposition that we must have such amazing currents of air in our great buildings. It is the toxin of fatigue which we have to fight, and we are not under the necessity of changing the air as rapidly as the engineers have heretofore declared imperative.

A sort of petty graft grows up in the building where there is such a great system of ventilation. It works out in this manner: The man or woman who happens at first to get into one of these drafts by the allotment of

desks makes quick complaint, and if he or she is of some importance in the eyes of those next to the head of the institution, he or she gets a change of desk at once. Someone less favored has to go to that place. The change is not made on account of the draft, but the business demands that the favored one be located somewhat differently and the successor to the spot gets the place because it is such a good one!

But if the favored one is so situated that he or she cannot be removed from that particular spot, then the deflector of air is put over the intake which supplies that part of the room, or which is supposed to supply that part. This deflector sends the draft away from the favored one and it strikes someone else, rather indirectly, but still so directly that it means real suffering to that one, or possibly a term of sickness now and then.

The pressure of the ventilating system is one of the great faults in our great modern plants. There is too great a rush of air for the welfare of those who are to sit in its range, and the results are bad. No man or woman who has been somewhat weakened by modern ventilation is able to withstand the attack of a column of good air, pure, sweet, and of the right temperature and humidity, if such can be found—no weak man or woman is able to live in such a draft.

We must reduce the velocity of the air rushing through our buildings if we expect employes to sit in them. The objection arises at once in the mind of the ventilating engineer, that any lessening of the velocity of the air will vitiate it and so endanger life from poison by increase of carbon dioxide. But we have shown the error of the old ideas regarding carbon dioxide. If we are safe to breath air containing four parts in the hundred of carbon dioxide we need not keep up the terrific

rate of speed of fans which are designed to prevent carbon dioxide from accumulating above six parts in the thousand. We have here a wide margin of safety, and we may without fear lower the rates of fans and get much less draft.

The need of ventilation is not to get rid of carbon dioxide, but to drive out the infection of fatigue which accumulates in any room where many persons are assembled, especially if many of them are weary with their toil. This makes the problem an entirely new one and it will require some years of experiment before we may settle down on data which will assure us how much change of air is actually required in a crowded place. We may be sure of this, however, that the present rate of delivery of fresh, hot air into rooms is not based on actual experiments as to the needs of the occupants of the rooms, but upon chemical tests to show the presence or absence of carbon dioxide. They are based on error and call for more wind than is needed.

Air must rush through at the pace of water in a mill race in order to secure that freedom from carbon dioxide which was formerly supposed to be essential to health and efficiency. But now that we do not need to fight carbon dioxide so vigorously we know that there is much less need of quick change of air than has been supposed. I have experimented with running an engine at about one-third the speed required by the carbon dioxide test and found the results were not bad. From present data, I hesitate to say just what the reduction in velocity of air change should be, but it seems that about one-half the speed of fans as laid down by the ventilating engineer of the carbon dioxide school will be quite as satisfactory as a faster rate.

Winter speed of changing air should be lower by far

than summer speed. A rate which gives entire satisfaction in cold weather when air is taken in at a very low temperature and raised from forty to eighty degrees, will not satisfy in the heat of midsummer when the thermometer ranges above ninety in the shade.

The reason a winter intake of air should not be as large as a summer one is evident when we think that air expands largely when heated. A thousand feet of cold air, taken in from outside at a temperature of less than ten degrees becomes considerably more than a thousand feet when raised to the temperature required for indoor comfort. More than this, cold air cut by a fan is more solid than warm air, and two hundred revolutions of a fan in winter throw very much more weight of air into a building than the same number of revolutions in summer temperature.

We must recast all our computations of the amount of air per person required for adequate ventilation, putting the figures much lower than we have had them, especially for winter. If we make the volume large we not only increase the cost, but we increase the drafts to which employes must be subject. When we increase the draft we must raise the temperature, making another increase in cost with greater detriment.

On the other hand, if we raise the temperature so that perspiration becomes no longer insensible but perceptible, we must increase the volume of air to take away the odor and the bad effects of the added moisture which the moist skin pours out. In an office where the humidity is fifty per cent of saturation before the employes arrive, there will be found from ten to twenty per cent more saturation after business has been going on for a couple of hours, provided the temperature is run high enough to cause a general putting off of coats.

In such an office where no humidity is supplied and the air comes in from the warming rooms with all the aridity of the desert, or worse, if the temperature is kept at 72 to 75, as is demanded by many under such treatment, the breath of the employes and their perspiration will largely relieve the lack of humidity and make a very perceptible showing on the dial of the hygrometer.

But the hygrometer test in such an office should not be taken at a point near the exit of air, for there the humidity is much greater than near the intake. Test the air as it enters if you wish to know what the degree of unnecessary suffering is in such a room. The drafts which will trouble every weak or ill person in such an office are fiercest where driest. The air directly from the duct is the air that is fatal because it has not had time to receive its contribution of perspiration and effluvia from the lungs of the occupants of the room. So it strikes with all the force of an icy chill, even though its temperature be high, and the resulting sore throats, aching ears, catarrh, smarting eyes, loss of sense of smell and taste, grippe, and pneumonia will be as severe as though there were no contributions of humidity from the bodies of the occupants of the place.

What is required is not the extraction of humidity from the skin or the breathing tract of the occupants of the room. The ideal condition of the air is that in which only insensible perspiration takes place, and that not rapidly, where the breathing tract is not attacked by the dryness of the air so as to cause a breaking down of the tissues of the mucous membrane and a destruction of its healthful secretions, where the temperature is not high enough to weaken the vigor and cause headache and irritability, where there is sufficient change of air to secure a passing away of the effluvia without making

any one uncomfortable with the force of the rush, and where there is a sufficient difference in quality of the air in different parts of the room so that the necessary changing about of doing business may afford some little variation of temperature and quality of air.

In such an atmosphere it is not necessary to confine the temperature to as strict limits as are demanded where the air is desert dry. A variation of three or four degrees of temperature does not affect the healthy human being disagreeably. It is only in hot, dry air that we are irritated when the iciness of the blast makes us chilly because of its dryness and our feebleness.

To reduce the average temperature in a large office where dry, hot air has ruled for months, it is not safe to make the reduction quickly. Although a temperature of 62 to 64 is perfectly agreeable where the air is properly humidified, experience shows that the occupants of the hot, dry place must first be treated to moisture before it is safe to lower the temperature.

The method of proceeding which experience seems to indicate is to throw in the humidity at first and keep the temperature up. Then reduce the air pressure to get rid of drafts. With the softening of the air and mollifying the drafts the occupants of the office or school begin to feel that they are not in danger of taking cold. They lose some of the stiffness in parts where they have suffered from the drafts. In a few days they become somewhat accustomed to being warm enough and otherwise comfortable. It is amusing to see the man who cannot endure the office air without his hat, take it off for awhile and feel comfort in being uncovered. Then the woolen wraps begin to disappear. The ladies keep their sweaters within reach, but do not have them over their shoulders much of the time.

Men shed their coats and perspiration begins to stand out on the foreheads here and there, a thing not noticeable in the days of hot, dry air. No matter how warm the man, the beads would not form on his brow while in such a thirsty air. But now the mildness of the air begets a confidence in it and even the engineer may be looked upon without a feeling of resentment. He does not seem to be such an unreasonable being.

When this thawing of sentiment in the establishment is brought about one may safely proceed to lower the temperature. But this should not be done until drafts are taken away and the occupants of the office have had a chance to enjoy the warmth for which they have been petitioning in vain. A drop of two or three degrees at first is agreeable to all. Then more degrees may be taken from the amount of heat. Slowly the thermometer may be induced to register lower and lower until about 65 is reached. This, though still too high, will be a great thing in a building which has always been hot and dry, for many of those who have been under the doctor's care and who complain bitterly and habitually of the drafts they have suffered in the place will be slow to acknowledge the benefits they are receiving even after their health has been improved and their suffering largely relieved.

A large office building with employes packed closely in all parts of the house where some are against the windows and others are directly in front of the air ducts is not a simple problem to regulate so that all shall have a chance to be well and comfortable. But conditions in it can be greatly ameliorated within a very few days, and by intelligent care and experimentation it is possible to adjust the ventilation, the heat, and the humidity to give health and comfort where under present methods

REALITY THROUGH IMAGINATION.

IN THE SWING. NORTHWESTERN SETTLEMENT PLAYGROUNDS.

which are called scientific the thing is impossible.

Patience and inventive genius are demanded in the one who undertakes this great task. His work will need to be gone over every month in the year, for new problems arise in the progress of the seasons and with the changes in the personnel and conditions of the business. Summer ventilation, cooling of air, and control of stagnant sections of the building make the problem in July a difficult one, though not one calling for such imperative directions as the conditions in the cold months.

Many sanitary engineers have been too well trained in the school of theory and there has been less contact with the actual conditions of life than there should be for success in their work. When they adjust the ventilating plant of a building and meet complaints with accusations of imagination and unreason they may content themselves with theories, but the public will not be convinced that the majority of the people do not know when they feel weak and sick from bad ventilation which science has looked upon and pronounced good with great solemnity.

No ventilating system is good when the persons subjected to it do not like it. It is idle to tell them that they are prejudiced and foolish. They are really suffering when they say they are not well. No amount of science is going to take away the guilt of the engineer who tells such persons they are not ill when they know the contrary to be true.

Good, right air is possible in a building of any size or shape. It may require a very different arrangement in the summer from that which is needed in the winter. But it is possible with skill and with the proper outlay of funds to get back that satisfaction which makes an outlay justifiable.

It is quite possible for the employer of skilled and expert service to adjust matters pertaining to air so that his employes will be not only pleased with what he does for their comfort, but they will be able to render accurate and persistent service which will repay him many fold for the expense of getting the air right which they must breathe while working for him.

It is possible to have the air of the schoolroom such that children may learn with ease and be free from many of the diseases and troubles physical and mental which now afflict them. No matter what the cost of making that air right, it ought to be made right. The road to getting it right I trust I have sufficiently pointed out, but to follow that road will require the ordinary patience and wisdom of the successful, ingenious traveler.

The larger the building the greater the problem. The greater the extremes of temperature between the lowest winter and the highest of summer the more the problem is deepened. But the problem has its solution. Moistening the air properly, stopping violent drafts, and putting the temperature as low as consistent with good judgment, are the means of making the occupants of large buildings happy, efficient, and well.

Drafts are dangerous under certain conditions—Drafts are highly beneficial under other conditions. Let us consider which drafts we may wisely get into and which drafts we ought to avoid, for it is a matter of life and death to all and many persons lose their lives by reason of drafts while others save theirs unconsciously by getting into them.

The most dangerous draft of all is one where the moisture that belongs in the air of the draft to make it natural and healthful is partially absent. There is no person so strong that he can sit in a dry draft for a long

time whether the draft is warm or cold. In many ventilating systems there are cool drafts where the air is a little lower in temperature than feels comfortable to the one who has to sit in it and there is a low per cent of saturation, say less than forty-five. In case of such a draft with less than twenty-five per cent of saturation, a thing very common indeed in modern buildings, there is no more dangerous spot than where that sort of air pours against one's person, especially from the rear.

It is simply suicidal to sit in such a draft. It is criminal for the employer or board to compel anyone to sit there to earn a living, no matter what the amount of money spent in "perfecting" the system of ventilation and getting a change of air which some engineer says is right.

A draft of moist air where the saturation is too great, say above seventy per cent, is dangerous to some extent. But such a draft is not found in the modern building. Only in certain factories is this danger to be found. What feels like a moist current of cool air is often in reality a current of too dry air. The evaporation from the surface of the body and the rapid radiation of heat in dry air makes the current which is really too dry seem to the patient to be too moist.

There must be change of air where there are many persons breathing. But the required change is much less than has been fixed upon by reputable engineers. If the persons sitting in the room are kept perspiring freely so the odors thrown off from their bodies are loaded upon the air, it will be found that fatigue and drowsiness are passed from one person to another until all in the room are enfeebled by it. In such a room more change of air is required than in a comparatively cool room. The true remedy is not in speeding up the

fan but in reducing the temperature so the weakening and excessive giving out of odors and salts may be made less.

The poisons we take in from a crowded room are rather those of fatigue and hot, moist clothing than the long-maligned but rather harmless carbon dioxide which the lungs give off in extremely small quantities. To avoid passing these poisons out upon the air and making their distribution general, let the place be kept healthfully cool, but not chilly. Where drafts are made by heavy fans running at high speed, cut down the speed or reduce the number of fans, take out a blade or two, or stop part of the opening of the fan casing, but do not deflect the air currents to other parts of the room or to other parts of the building by putting deflectors or dampers over the openings where the air comes into the room. Choking it back in this manner means merely sending it on another course and inflicting the torture or the danger upon some other person who may not be able to get the attention of the manager in regard to the matter of personal health and comfort.

The dangerous drafts are dry ones, whether cool or warm. Those coming from the rear are dangerous, whatever their nature. Also drafts that come in at small apertures are to be avoided. If but a small portion of the body receives the force of a small draft, that is a matter for immediate attention. Neuralgia and rheumatism may be brought on or aggravated by such small drafts. Toothache and local inflammation may be expected where the small draft has access to part of the body. Sitting near a closed window which is leaky is often the cause of much suffering. Screens, wraps, or removal should prevent exposure to such.

Most drafts may be made beneficial by giving the

dry air moisture. There is rarely a draft in any modern building which is not too dry. If it may be humidified properly the draft will become a beneficial rather than a detrimental one.

The skin should be kept dry in order to get the benefit of a good draft. No one can sit in a draft and perspire at the same time without running considerable risk. This is all the more true if the perspiration is the result of activity now ceased or of heat which has been endured and is now not present. A dry skin tends to make all drafts beneficial.

The mental attitude of the one in the draft often has a strong influence over the character of its effect. If we fear a draft we had better keep out of it until we get over that fear. Cringing before the blast is a weakness which gives the blast the advantage. An active and joyous opposition to cold and chill often overcomes it. He who enjoys a draft is not liable to be injured by it except when he merely enjoys the draft to stop his perspiration.

When one is unfatigued, a draft of almost any character loses its terrors. It is the weary one who gets the dangerous illness and the pain which a draft carries when it is not a good draft. The body that is full of vitality and resistance to disease and to all adverse conditions, meets a draft in a conquering mood. Vigor is better than an overcoat in resisting chill.

Deep breathing may change a draft that is dangerous into one that is truly beneficial. When you find yourself in a draft that seems to be dangerous, begin breathing deeply and it will change the character of the draft. Keep it up indefinitely and the longer you are subjected to the draft the better your vigor and resistance will become. Probably the chilly draft is purer

in character than the air it comes into, and if so that is to your advantage. When you step out of doors and find you have not enough clothing for comfort, begin breathing deeply. This will add to your clothing the effect of one extra garment of heavy material.

And so it is not so wonderful that the Japanese prefers to get right into a draft when he finds one, for he lives the sort of life, as a rule, which makes all drafts wholesome and helpful to him. The American usually has so much clothing on as to keep the skin moist and he lives in such a hot, dry air that his system is enfeebled by it. He must keep out of the draft which brings vitality and pleasure to the oriental.

Drafts are helpful to the peripheral circulation of the blood. The redness of skin which is sometimes observed with alarm is merely a good sign of work going on that ought to be done. The blood is tingling along through the capillaries and ceasing to clog in places where it can do no good. Air moving against the skin, especially cold air, often helps this part of our circulation so as to be of great benefit.

In crowded places where the air is too warm for comfort it sometimes revives one to get a gentle pressure of air against the skin even though it may be a very small area that catches it. The use of the fan is not as nonsensical as many persons believe. By pushing a small current of air against the skin and keeping it in motion the temperature of the part is slightly reduced, which is gratifying, but also the reaction of the skin assists in the elimination of the toxin of fatigue. We are not so tired after a few seconds of fanning gently when in a crowded room. Until Dr. Weichert's examination of the action of fatigue we were unable to understand why gently fanning rests one, but now that

it is recognized as assisting in creating the anti toxin against fatigue poison, the fan is acknowledged a more beneficial implement. The man enclosed in a box where he had to breathe bad air became much improved when an electric fan in the box was made to throw the bad air against his chest gently. The action of the fan seemed to produce the same effect as permitting him to breathe fresh air.

Drafts are also beneficial when they assist lung expansion. The motion of the air induces one to breathe more deeply and enjoy the better air which the draft brings in. Any increase in the expansion of the lungs is beneficial at the time and in the future.

The draft that increases one's resistance to disease or to cold is also a good thing. It helps the body to maintain vitality. Every addition to one's vitality or resistance is valuable.

On the whole, we may consider drafts as friendly to our well-being, for when they are not too dry, too strong, too small, or from the rear they assist the bodily functions, and when the skin is dry, the system active, and the mind cheerful, we get an increased breathing, an added resistance and vitality, and an increase of peripheral circulation which are highly to our advantage. We should learn to live in drafts. We should learn to produce drafts in our buildings, drafts which will promote and provoke health. We should overcome the habit of fleeing from drafts and cowering before any chill that may present itself. Being superior to the attack of harmful draft and having intelligence to welcome a beneficial one, we are in condition to meet gentle currents of in-door air with fortitude, knowing that the fittest survive best.

CHAPTER XIX.

Humidity in Churches.

In this chapter I wish to show why sermons are dry and why many men rarely go inside a church. The case is not so serious in the Catholic churches, for in them, as a rule, the service is very short and the temperature is not kept high. It is thought that worshipers in their outdoor wraps do not require as much heat as in their homes and it is satisfactory to have the temperature quite low. But the protestant churches have the custom of keeping their edifices toasty warm and retaining their audiences and Sunday school classes considerably over an hour at a stretch.

Consequently I wish now to address the members of the evangelical churches and make a number of plain statements of what appear to me to be serious hindrances to their success in attempting the bringing of mankind generally to accept the gospel.

The revival of the old days seems to have passed. We have great meetings frequently, but it is only on rare occasions that a general coming together of the people of a community can be brought about for revival services. There is much more to be said on this subject than I may take space for here, but the humidity of the church building or the place where the services are held has much to do with the failure to enlist the cooperation of a large number of workers and the attend-

ance of many who are not already on the rolls of the church as members.

People are weakened by the systems of ventilation now in use in our cities and large towns. We have paid out much money to get pure air into our public places and houses are as a rule so well built that there is no chance for outside air to humidify the inside air of any of our buildings whether shops, offices, stores, schools, or even residences. We have perfected our ventilation provisions to such an extent that the places where men and women as well as children spend their hours and days in the time of cold weather are uniformly warm and very, very dry.

Spending most of their time in this dry and unhealthful air, the bulk of the people become so weakened that they are unable to do much more than the work which their business or their profession demands of them. We are surrounded by tired persons who are lamenting that they are so crowded with work and engagements that they have no time for social enjoyment and are not able to do all that they feel they ought to do for the good of the church and their fellowman. They feel they ought to do more, but along with this feeling goes that sense of helplessness which induces them to say, I am already working close up to the limit, or even beyond my strength, and I cannot with justice to my family or to my own duties take on any further engagements.

This is common with men and women and to a large extent with the children. All seem to be under burdens greater than they really ought to bear, and it is physically impossible for them to do for the church what they wish in the way of supporting and participating in the

meetings held for the good of the community and the increase of the membership.

But these persons may be made strong—Almost to a man it is possible to give them a vitality and resiliency which will produce abounding ability. It is the great duty of the church to take hold of this important question and see that its membership does not fall into the state of those who are unable to do anything further than drag out a weak and unsatisfactory existence. The strengthening of all the people in a community may seem a great undertaking, but it is entirely practical and the churches may as well take hold of it in earnest, for it can better be done by them and the schools combined than in any other manner.

If the activity of a church can put vitality into the men of a community and make them really stronger than they are at present, make them capable of doing more business, supplying their families more perfectly with the things desired, contribute more liberally to the church, feel more capable, and desire to do more, what better thing can the church set itself at in the line of great undertakings? A general revival of physical vitality is practicable for any community. It may be inaugurated with or without prayer. It may emanate first from the determined minister or it may be brought about by the earnest solicitation and argument of one or more laymen.

It is within the reach of any community, and when it has once been set in motion it will heal the sick, strengthen the weak, reform many who are dissipated in different ways, and perform many other seeming miracles, even going so far as to prolong life, which is quite equal to raising the dead. For what can be better for the man who is about to yield up his life

through physical and mental weakness, loss of ambition, and loss of hope in this world, than to put new vitality into him, strengthen him physically and morally, enable him to exert himself with his old vigor, and snatch him back from the brink of the grave? Which is better, to save from death or to raise the dead? It appears to me to be nobler to snatch the weakened one from the brink of the grave and infuse him with new life than to permit death to lay hold on a man and then bring back breath into his nostrils after he has given up the ghost.

A campaign for good air is what the churches should undertake. If we can demonstrate to the people of a community how they may become strong and efficient, how they may make the world better for their existence, by securing right air to breathe while they work, and eat, and sleep, we can put that community in the way of salvation. If all put their minds to the task it will be surprising to all how easily the thing can be done.

The campaign will be joined in by those who are not at all in sympathy ordinarily with the churches. There are many persons of intelligence who hold an aloofness to the church who would say, That is something worth while; I'll go in with the church folks on that. By getting their co-operation in the campaign for open air you may get their continued activity along other lines and finally convince them of the value of closer union with the people of the church and closer conformity to its teachings.

Let us look in at the modern revival as conducted in most churches in the last ten or fifteen years—since the ventilation work has become so deadly in the places where we spend the week that we have to keep the churches heated above 70 when we undertake to hold a service. In the beginning of the revival most of the

church members are much interested. Some of them promise to come out every night and support the work in every manner.

But nobody but the church members takes any particular notice of the services. Now and then a few outsiders are induced to come in for an evening, but they do not return. They try it once or twice and that is all. Possibly you may hire an evangelist who is able to do stunts. He may talk faster, pray louder, sing worse, exhort more vigorously, or make faces and tell funny stories more cleverly than anyone else. He will get more to come. There will be a pretty good crowd of persons of more than average physical resistance who will come out to be entertained. But the lack of ability to take hold of these persons and do much with them soon becomes a matter of comment, and where one or two are given an interest in spiritual things, ten of them slip out after the novelty of the evangelist's performances begins to wear away, and the people say, We had a revival, but our people did not support the work as we expected and we could not get the interest of the outsiders, and while we had some excellent results it was not such a revival as we hoped to have.

The whole community is weak—The vitality of all the people in the neighborhood is low. All are sapped in strength by the hot, dry air they are compelled to breath through the cold weather, and they are not able to do what they wish. The members, after a few evenings of stress to keep their promises, began to find good excuses for dropping out. The outsiders who came once did not come again. They had headache when they did come and found themselves weakened the next day by something which they did not fully understand, and so

they, without having any particular reason, kept away from the meetings.

Men stay away from the Sunday service and the special meetings for the same reason that the farmer sits in the kitchen rathen than in the best room. The farmer gets out where the teakettle is boiling and where the air is humidified. If you ask him why he prefers the kitchen he will probably tell you he feels more comfortable there where there is no style demanded, but the truth is, he feels physically more comfortable there than in the rooms which are heated by baseburners, making the air dry. The man who works outdoors or who toils regularly at any bodily strain goes once to church and gets so drugged with the dry, hot air that he is ashamed for not keeping awake or for not getting interested. He is discouraged because he cannot follow the sermon or the service. It is so much like what he remembers of school, only more so, that he does not care to repeat the experiment. So he stays away from church. It is not for him.

Ask the man why he stays away and he will try to give a reason. He will not hit the right one, but will bring up something about not believing, or being disgusted with the hypocrites he saw there, or the dryness of the sermon, or the bad music, or anything but the air of the place. He does not know why he does not like it, only he is pretty sure not to go there again.

Why do not more men go to church?—Because mighty few men can stand the sort of purgatory provided for them there. Women go because they must get out of their houses where they suffer so. Any port in a storm suits them. They cannot go to the saloon, but they do go to church, to their club, to card parties, and to other similar places of physical torture because they positively must have a change from the house where they are

kilndried and worked hard. Some of them say that when they step into a public place they feel as if they must scream. Their nerves are so wrought up by something, they cannot say what.

It is the hot, dry air having its natural effects upon them. If they were confined to the air of the house, the club, the church, the card party, and the school house without the advantages obtained by the acts of going and coming—if confined in that air for six months without a chance at the open air, nine women out of every ten would be dead. If men were confined in it without the chance to get out, similarly the whole ten would be dead in less time than that mentioned.

So you can get women out to lectures, concerts, theaters, church services, and the social gatherings where they do so much good to the poor and harm to themselves with needles and tongues. They are obliged to go to these things, for they have no alternative. But the men have other resources. They can steal away to the billiard room, the saloon, the street corner, the club, the blacksmith shop, the car barns, the bowling alley, and many other places, some reputable and some disreputable. Fortunately for them, as things are, they do not have to resort to the sort of things the women are obliged to take in.

There is another physical reason why men and women do not go to the same sort of places. It has nothing in particular to do with fresh air, but I mention it because it will have a bearing on our planning the fresh air campaign. Men are not naturally sitters as women are. The width of a man as he occupies a chair is much less compared with his height than that of a woman. Not only is she more stable in contour, but her center of gravity is much lower than that of man. She also wears sup-

porting gear. Consequently she can sit up in a pew or on a straight chair without lopping over. Man cannot do this without much greater effort.

Women, being built so stable and well braced for sitting, do not lop over in church as men do. It is not so much of a task for a woman to sit through a meeting as it is for a man. If the sermon runs well up towards the sixty-minute line, she is not greatly disturbed, for it does not take much pertinacity in her to keep her seat, but the man, unless under strong stimulus, as love for the girl who brings him to church, or certain social or business advantages of being there, or great religious fervor, resolves that he will find some way of escape when next Sunday rolls around.

This makes me think that when we make our campaign for open air we must plan things so men will have the freedom to be on their feet, or lounging, or doing something about the place to assist in the service or waiting on others, or they will take their fresh air out of doors and the campaign be not a builder up of congregations.

But the air in the church must positively be better than we are supplying ordinarily or we shall have to get along without many men. When I say better, I do not mean that the air in our churches is foul. I simply mean that it is deadly. It is from ten to twenty degrees too warm. It is so much drier than the atmosphere of the driest climate on the face of the globe, that it merely emphasizes the troubles of the people who are already suffering from dry, hot air, and the service closes with many a headache and many other troubles due entirely to the unwise preparation of the house for the meeting.

No wonder many children hate the church—They are taken there or sent there because they ought to go. That

is not much of a reason for a child. It serves well for the parent, but it is not good argument for a live child. But if he ought to go, and then has to go, he goes. If he belongs to a religious family of intense purposes he is ordered to go to the morning service and to the Sunday school. Both sessions come before dinner. Not before the usual time of the midday meal, but before the time when he is going to get anything to eat on the Lord's day. This alone makes the case serious to many healthy and proper children.

Suppose the Sunday school comes first. That is the more humane supposition from the child's standpoint, for he may be able to drowse off in the church service and he is not so hungry in Sunday school if it is set for the time before church service. The room is crowded. One of the purposes of a Sunday school is to see how many children can be persuaded to attend so they may be counted when the word is given, "We will now listen to the report of the secretary." That is generally a falsehood, for nobody but a few listens to the reading of the report of the secretary. But suppose you get a large crowd of children there, it will be instructive to any open-minded person to follow any one child through the program for one session and see how much of the time somebody is putting in in trying to get the children to do something they don't wish to do and which they find they really do not have to do. How little of the time of the session actually goes into anything of permanent value to anybody! Yet all are there in response to religious duty or to the importunity of somebody whose religious duty it was to get others to come. Possible to get a blue button for "our side."

The Sunday school room is hot and dry. Dry in all senses. Stupefying conditions affect all, but not all

alike. The villainy of some boys is brought out in strong relief in Sunday school. Able to resist all forms of suasion presented, they spend the session in doing all the mischief they dare, and what they dare is often quite surprising. At least one teacher out of every four goes home with back aching and lamenting to herself, if not aloud, the lack of success she is having with that class. The torture she is enduring that those children may have the benefits of Sunday school instruction ought to win her high favor in the world to come, for it will not get much for her or the class here. Any class conducted in disorder does much harm. Whether more harm than good, may be judged differently by different observers.

But the school smells rank in the last half hour. Those present cannot smell it, for their olfactories have become deadened by it. The air is vile. The hot, dry air has become hotter, and it is now laden with moisture. Where did it get it? Out of the perspiring bodies and from the lungs, throats, and nasal passages of the members. If the throats are parched, the children are urged to sing louder. "Oh, you don't make half as much noise as the school I heard sing last Sunday, and there were not a third as many of them as there are here!" But the leader of the shouting ought to know that noise is not music always, and possibly if there were one-third as many here now as there, those who were left might make more noise. They are stupefied with the atmospheric heaviness.

Now, if I seem harsh in this statement regarding Sunday schools, please do not quote me as not believing in them, for I have been superintendent of Sunday schools, much of the time of two at once, for many years. But my having had so much experience in schools, some of which, possibly, were better conducted than any the

reader has ever seen, for good Sunday schools are rare, I may be pardoned for noting some of the faults of schools in this appeal for open air, for there ought to be good air in every Sunday school, or there ought to be a very brief session.

Look in at the infant room, or the primary department—How often the woman who can talk loudest is chosen to lead the little ones! How often the woman who can make the most fuss in singing, leads the alleged music! The little ones are huddled close together, not always with their outer wraps removed. The air in there is worse than in the main room, for it is so close that there is no chance for change of air, and the women in charge would not permit any child to take cold by having any draft in the room.

The great objection to kindergartens is here in full force, only more so. If there are any contagious diseases in the neighborhood, here is the place of all others suitable for infection. By bringing the children very close together, by having them remain long enough so every child has breathed in many times air that has been down the lungs of many others, by having all sing vigorously so as to increase the throat action and lung expansion, by marching about, and by inducing much perspiration, what more could you do to spread infection? These children are at the age when their resistance to disease is very low. They will take almost any infection without actual contact. But in the crowding, the holding of hands, the affectionate kissings of the little dears, there are arrangements made for many an unnecessary funeral.

The mothers of most of the children are either at home getting up the big Sunday dinner, or they are in other departments of the school "teaching" or officiating,

or doing something of great value instead of being in attendance on their own children.

Add to all this trouble in all the school the fact that the air which has vitiated the lungs and breathing tracts of all the community during the week gets a better chance on Sunday in the Sunday school. It is even hotter and drier than what the people are accustomed to enduring at home. The pains of the place are severe. And then comes church, either in the same room or in a hotter one. Brethren, I judge there is something to be learned by us fishers of men if we are not to go about in the future with an empty stringer.

Are we doing the best thing for children to huddle them in such a heat in order that when they grow up they will know much about the Bible and will have the habit of going to church fastened upon them?

Is it not clear that the reason our children generally, who have been ten or twelve years in the Sunday school regularly, do not know anything about the Bible, the church, or their own status in regard to the kingdom of heaven, is that we have put them under conditions where learning these things was impracticable? We have given them the worst features of the day school only intensified and made more vicious.

Now the church must become a leader in a new way—It must fight the battle for open air. It must be humidified so that when we enter its walls we shall have that restful experience which comes to one who knows what it is to breathe warmed air which is not too warm and which has the humidity of open air, just as good as that outdoors, and warmed enough to be comfortable. We must provide such air in our churches that workingmen who are accustomed to the open will not grow languid while in them. We must clean out the Sunday school

and make it a pleasant place to which children will turn with delight. Its air must be good and its methods quite different in order to make the instruction worth the name. A whole chapter ought to be devoted to how to make the infant department safe and sane.

The command to present our bodies a living sacrifice must be obeyed. This cannot be done while the poison of fatigue induced by hot, dry air remains in them. We must get rid of the toxin of fatigue in ourselves and get it out of the blood of the community by sensible, concerted action which will inform all of what nature demands, and then see to it that in our public places as well as in our homes there be given to all a chance to experience healthy, vigorous activity, and enjoy being alive.

It will not do to say that the people have forsaken God and so have left the churches. They have been tortured out of the churches. They do not know why they do not attend church, most of them, but they can give a sort of excuse which answers for the time, but is not the real reason.

Now it is the duty of all churchmen to join and bring them back. First, get strength for all by a great campaign against a poison worse than strong drink, and then give them a place to worship where they may truly worship in the spirit of holiness.

Complaints have come from clergymen recently that the workingman is forgetting his religion and that few men who toil, especially in our cities, ever attend church.

The laboring man's avoidance of church is a great question, but the fault of forgetting his duty to God should not be too lightly charged against the man who works in open air and refuses to sit in church on Sunday. With the customary heat turned on and the usual dryness of the air in a church, it is a physical impos-

sibility for the ordinary laboring man to sit through a service and feel well. It is true that he is often unable to appreciate the culture of the minister and his long words, he sometimes is slighted by the well-dressed members of the congregation, and he feels he is out of his element in the place; but these do not drive him away. There is one reason why we should not expect the man who is accustomed to right air to spend any time in such air as is found in most of our churches.

A drowsiness comes over him soon after entering. He cannot bring his mind to attend to the service. His head begins to ache in a dull way, and if he does not actually disgrace himself by lopping about and dozing a little, he is to be congratulated on his command of himself. He sees a congregation of persons who habitually treat themselves to that sort of air. They seem able to endure it; but he is of different fiber. When he gets away from the place and thinks the matter over, he resolves that the church does not exactly fit him and he will seek a place next Sunday where he will feel more at home.

A man who has once snored in church is not likely to attend there afterwards. If his wife has had to nudge him repeatedly to keep him from falling asleep, he is likely to remain away next time so he may sleep quietly if impelled. He probably does not know that the Dover's powder was supplied in the hot, dry air and that it was no fault of his that he was drowsy, stupid, and dull. He has to be a man of great power of self-control, deeply religious, or deeply in earnest over attending church for some other reason, to become a regular attendant while his occupation on week days makes him acquainted with natural air.

The laboring man will attend church generally when

the church is ready for him. When the air is made natural and is of a temperature fitted to comfortable existence for the natural man, then we may expect men who work at heavy toil in the open air to attend church. They really wish to attend, but at present it is out of the question.

Dwight L. Moody opened a series of meetings at Dartmouth College a quarter of a century ago. He preached the first sermon and nobody seemed much interested. General indications were that the series of meetings would not succeed. But as soon as the congregation had gone, Mr. Moody went down to the basement of the church and got on his knees before the heating apparatus. He discovered that there were no evaporating pans in the furnaces. Then he had some made which would hold water and make steam whenever the fire was going.

"There," he exclaimed, "now, I guess the sermon won't be so dry this evening."

Whether he knew this thing scientifically or not is immaterial. He knew when his audience was not listening, and he had found out by experience that hot, dry air is not good for a service. In the old days every farmer knew that the stove must supply moisture, and it was common for people in charge of church or schoolhouse to see to it that water was supplied. But since we have farmed out our ventilation to people who know so much about it that they fix the apparatus and tell the engineer and the janitor not to touch it, but leave it right there as it is, a generation of people is now in charge of affairs in total ignorance of the greatest necessity in a ventilating plant.

The churches of the South are much better attended than those of the North. Northern visitors who attend

church in the South are struck with the general habit of the people of attending church. All the churches seem to be filled. The people go to the church as regularly as to the circus. All seem to have to go; it is the custom to attend.

In the North few churches have enough congregation to keep the leading members from apologizing to every stranger for the slim attendance on that day. It is rare to find a church in the Northern states where the audience room is one-third filled for a regular service. Now and then special occasions pack the churches, but as a rule the people who are members of the churches in the North do not attend regularly. A church of six hundred members rarely has two hundred present by actual count. It often happens that not ten per cent of the membership can be found at an ordinary service. The prayer meeting in the middle of the week rarely contains one-tenth of the members of a Northern church.

The probable cause of this discrepancy in church attendance between the two sections of our country is due to the difference in climate and the condition of the churches in regard to air. The Southern church requires little heating and its air is naturally about normal as to humidity. The number of Sundays when artificial heat is required is small. But in the North heat is required nine months in the year, and nearly all churches have such an overheated and dry atmosphere that those who enter once do not return if they can avoid it. Conscience and sense of duty brings some of them back; but because the people generally are made so uncomfortable when they are present they stay away, except for occasions of great special interest. But they will not, as a rule, support any meetings in series for the

extension of the usefulness of the church in the community.

Other weakening features of our ways of living should be avoided. The church should learn to keep good hours along with good air. Among the changes which the worldly-minded have brought about recently is the shortening of the hours of amusement so the participants be not too much wearied. Dances twenty years ago lasted all night. Then the hop became fashionable, stopping at midnight. Now dancing parties often break up at eleven. The wearing effect of sitting in a hot, dry room, in a religious service lasting two hours, is much worse than dancing four hours, even with imperfect ventilation.

Unless the house is well ventilated, the air properly humidified, and the temperature low, the religious service which exceeds an hour is dangerous. It is dangerous because the enfeebled condition of the audience prevents a proper consideration of the sermon or service and a deadening spiritually ensues. We should give our very best attention to the things of God. It is wrong to drug ourselves into inattention and offer Him feeble homage and adoration.

The long service in imperfect air is dangerous in another serious way. It adds more fatigue to the already enfeebled audience and, perhaps without their knowing why, gives them a feeling of repulsion. The church or school which saps vitality is unconsciously or consciously disliked by those who suffer. None can resist this dislike except such as are so enthusiastic over religion as to bring the consideration of comfort or health into complete disregard. One may have such devotion as to reach this state, but it is idle to imagine

a congregation or a whole community will share it to any great extent.

How may a service be shortened?—In the first place, possibly it does not need shortening. Give it right air and it may be right in length also. But if the air is not excellent, like the open air of summer, pure, humidified, and mild, a short service must be held or people will remain away largely and those who do attend will not be greatly benefited.

I assume that most churches, in spite of the fact that the matter of life and death in humidity or lack of it is so crucial, will not get right air. Church boards are made up of men who are succeeding in life but half killed in the process. They are largely in a lethargy except when they see a dollar and stimulate themselves to pursue it. Such bodies will not make the fight with the janitor and the furnace man and get right air. They are too feeble to remedy their own and others' feebleness.

So the service must be shortened so the sermon and worship may be effective. Let the singing be prompt, the hymns familiar, the organist intelligent enough to play so those in the audience may know when to start a line, and the tempo not dragged. Omit the long announcements. If you cannot afford to print them, put them on a large blackboard. Or give out word that only written notices will be announced and these must be like telegrams, ten to twenty words. Permit no emphasizing of notices by anyone, for where all notices are made emphatic it is done at the expense of the sermon, and when a church is treated to superlatives for awhile they become like the cry of "Wolf!"

The sermon may frequently be bettered with the blue pencil. Learn from the editors that people who will not read a solid article of great length will not at-

tend when a solid sermon is spun out. Most clergymen have a notion that they must have time to treat the subject properly. They ought to form an anti-treating organization. It is this formal treatment which so often treats the auditor with torpor. All the time taken in explaining how I happened to choose this text, how others look at it in a wrong light, how it might mean something else if it were different, why we ought to study it closely, what authorities have treated it, and how much time I have spent on it, is usually worse than wasted. It consumes energy, weakens the appeal, and contributes to inattention.

When a speaker from outside is introduced, do not take the edge off his message by stringing out an elegant introduction or bragging. When he is through do not hold the crowd longer to hear what you think about it. Let them think. If the strange speaker cannot boil down his seething message to reasonable limits, find it out in advance and don't introduce him.

When an editor asks a writer for 1,000 words he estimates it is safe to use no more on that subject. Any subject may be presented helpfully in 500 words. No subject can be treated exhaustively in a million. You and the editor must set limits or lose congregation and subscriptions. Learn the gentle art of condensation. Learn also what sort of statements your audience can understand. Find out how to use short words and short sentences.

If the air is bad you must jump and shout a bit or lose your audience. If the air is perfect, a little ginger in the speaker will help. In bad air a twenty-minute sermon is better than a longer one. Choose whether the sermon or the music is to be the feature or the serv-

ice. Give one or the other a chance by providing time and good air for it.

Let the social functions of the church and the business sessions be brief. Dispersing at nine o'clock builds up interest. Continuing till towards midnight may be good at the time, owing to the importance of the occasion, but there is a different feeling in the morning. Better consider things briefly at night than regretfully next day.

The young people's meetings and socials should not be permitted to outrage the sense of propriety of reasonable parents. Do not say, "We could not break up the function earlier." Perhaps you could not break up that one, but you did a great deal towards breaking others that are to come later.

Young persons with lessons to get or work to be ready for tomorrow should not dissipate in the guise of religious enthusiasts tonight.

It often happens that a church function drags on interminably because no one is enough alive to get up and go. The nickel theater is better managed. It lets out. You may go without offending at any time between acts. In most of the church evening affairs you are conspicuously rude if you escape the more poisonous part of the session.

If your church is well ventilated, humidify the air and lower the temperature. If not well ventilated, do the same thing and get the people out of the bad air quickly.

CHAPTER XX.

Right Air in Some Progressive Schools.

It will be pleasing to our readers to know something of the success of a few educators who learned early of the work of the Graham school in the matter of open air and got at once into the line of progress. Among these I will speak first of a young Chicago woman who took a rural school last fall and discovered when the cold weather set in that the conditions demanded by the children were liable to inflict lasting injury upon herself, and she found a means of escape in the work done at the Graham.

Miss Helen L. Black is a clever young woman with more than ordinary preparation for good work in school. She not only fitted herself for the profession of teaching by taking the usual courses of study along academic lines, but she went in for some special athletic features which have given her a poise and evident vigor which few women attain. She is an expert in the art of fencing. The quick action of this exercise early appealed to her, and the charm of the grace given led her to believe it could be imparted to children with great profit to them.

Being thus filled with physical vigor and alertness, she was quite unprepared for the degree of warmth demanded by the children of her little rural school when the cold weather set in. The school room is but eighteen

by twenty-five feet, and the large heater in the back of the room was found to be a wonderful promoter of lethargy and dullness. When the stove was going full blast the children were particularly happy and very sleepy. There seemed no alternative for her during the winter except to do as other teachers have done, let the children bake as they chose and herself suffer as much as is inevitable when one has to remain awake and go through the forms of teaching children who have lost the ability to attend and some of whom actually fall asleep unless urged repeatedly to remain awake and attend to lessons.

Miss Black made a study of the humidified air of the Graham school and the possibilities of lower temperatures than most persons think right. She secured a galvanized iron pan and placed it on the stove, where it was not liable to become dislodged, and set it boiling. So near was it to the fire that its boiling made a merry noise in the school room all day, and all day she kept the thing humming and throwing out steam which permeated rapidly to all parts of the room.

Fortunately the ceiling is about twelve feet high. The windows run well up to the top of the room, and openings at the tops of the windows are far enough from the heads of the pupils to make it practical to have four of the six open from the top all the time. They are let down about six or eight inches each in stormy weather and further when the weather is mild.

The temperature which Miss Black found necessary to satisfy the children when cold weather set in was between 75 and 80. This was intolerable to her, but for some time she endured it as best she might until she learned of a better way. She had hardly got the water hot before some of the children began to note a difference

in the air. They were pleased with a lower temperature, although she did not tell what the experiment was, but wished to try the matter out without having the minds of the children influenced in any way by imagination concerning what she was doing or wished to do.

Within a few days she found the temperature was down to about 62 degrees, and some of the children insisted on having the doors at the back of the room behind the stove opened part of the time. She also found that this low temperature was grateful to her although she had been accustomed to 70 and had supposed that was the right degree for indoor air in winter.

The average attendance in the school is about twenty. But the work was heavy before the experiment was made. Then she noted that the sleepy appearance of the children passed away. They began to take new interest in their work and were able to understand things with much less explanation and repetition.

A positive advance in mental alertness soon was established among them and the work of the teacher passed from a sort of drudgery into a highly enjoyable process of giving out information and helping the children to get knowledge for themselves from their books. A boy of eleven years who had been suffering for some time with a series of small boils from his elbow down began to get relief soon after the humidity was applied. The great improvement brought about in that rural school by the use of a little water and a great saving of coal demonstrates that the best work that can be done for our rural schools is to give them an atmosphere conducive to good health and clear thinking.

Boils and carbuncles are among the symptons of living in bad air—I have asked many men who began their work as educators in rural schools where the heating

was provided by large stoves, whether they were troubled with boils during the first year of their teaching. Many of them have said that they had great trouble in this way the first winter, along towards spring, but that afterwards they were free from them.

A gentleman who now holds one of the best principalships in Chicago began teaching in the lumber woods of Wisconsin. He was thirty miles from the nearest town where there was a regular physician. Along towards spring the teacher was annoyed by a swelling on one cheek which grew inordinately and gave him much pain. There was a backwoods amateur surgeon working near the school and he was appealed to to open the carbuncle. He said it might mean death and refused to touch it. As the carbuncle continued to grow and give greater pain, it was at last found necessary to dismiss the school for two days and let the master go to the settlement for treatment.

He walked thirty miles to town. There he found the physician, who soon opened the carbuncle and removed a large amount of pus.

"Now, Doctor, I want to know what I have been eating to make such a foul collection of pus."

The old physician asked all about the diet of the teacher and found nothing in it which should produce a boil.

"You are teaching?"

"Yes, sir."

"You have a large box stove in which you burn wood to warm the school?"

"Yes, Doctor, we have a fine stove and it keeps us toasty and comfortable in all kinds of weather."

"Well, there is the trouble. You get a large pan full of water and keep that on the stove all day. Open your

windows for ventilation, and keep the pan boiling and you will have no more carbuncles."

As a rule lady teachers do not have such boils, but men who come into the school from some outdoor occupation and keep the ventilation down and the temperature up, as a young man is liable to do when he is trying hard to teach a fine school and has not thought left to give to ventilation or humidity, is pretty certain to have a great eruption somewhere before the vernal equinox. I had one myself and know about it.

Superintendent W. W. Lewton, of Hawthorne, Illinois, has a system of school buildings to supervise which are so different from the schools of Chicago in their heating plants that I urged him early to make an experiment in one of them to see if he did not desire to have humidity supplied to all his schools before the coming of another winter.

The Hawthorne schools are heated by steam radiators and the ventilation is mainly from windows. Mr. Lewton found that he could give the rooms humidity by opening the vents in the radiators right in the school rooms. This gave a slight hissing of steam, but did not disturb either teachers or pupils. This worked very well in severe weather when it was necessary to keep the radiators hot all the time, but when the steam was cut off from a radiator the issue of steam from the vent was also shut off. He soon found a means of obviating the difficulty, for by inserting a small stopcock near the floor where the steam comes into the radiator, he got outside the shutoff valve and was able to keep a steady flow of steam into the atmosphere of the room whether the radiator was hot or cold.

In such rooms it is always the custom to try to keep the temperature at about seventy degrees, but the prac-

GARDENING SHOULD BEGIN EARLY.

A KINDERGARTEN TRANSFORMING A VACANT LOT.

tice is to let it run higher rather than be in danger of having it drop to a degree which would be uncomfortable to any of the pupils. Without taking any definite data regarding the temperature before the experiment, he reports that it may safely be assumed that the average temperature before the opening of the steam vents was somewhat over seventy.

After some days of experimenting it was evident that the teachers and pupils felt oppressed when the temperature was as high as 70. They had to keep it lower, and observations made at intervals show that the temperature was cut down on the average about nine degrees in all the rooms of the building tested.

The results of the test are so gratifying that he has arranged for equipping all his school rooms with openings in the radiators so there may be a supply of humidity in each of them and a saving in coal may also be made.

Investigation of an epidemic of diphtheria in the city showed that the schools affected by it were the only two rooms in the whole system where the heating was entirely from stoves and where the windows were not opened as freely as they should have been had the air been less dry at the outbreak of the epidemic. This seems to verify the opinions of physicians who claim that the foul air diseases are invited by shutting oneself up in a close room and applying heat enough to weaken the constitution. The resistance of these children in the rooms warmed by stoves was lowered so that they of all the city, most of the children in the city probably having been exposed to diphtheria, were the only ones to contract the dreaded disease.

The first school in the state of Indiana to adopt special means of humidifying the air is the Lowell school in Indianapolis in the charge of Miss Mary McGee. During

the discussion of open air work at the annual meeting of the Department of Superintendence of the National Education Association, in March, 1910, she asked for particulars regarding the use and production of humidity in a school like that over which she is principal. I went to the school and with the engineer examined the heating plant. As that is different from any heating system I have spoken of in other parts of this work, I will tell about it.

The air is sent into the furnace room by a powerful electric fan with current supplied from outside the building. The heating is done directly at the furnaces so there is no production of steam provided for in the system. As humidity cannot be given in adequate quantities without being supplied in the form of steam, I feared the problem would be a hard one to solve. I found that the five furnaces which are connected in one battery have two air chambers, one under them supplying cool air, and the other above the furnaces where the air is brought to a very high temperature. A system of dampers is calculated to enable the teacher in each room to secure just the sort of heat she desires by adjusting a damper, if she can think of it at the right moment.

Some of the rooms were very warm when I arrived and the teacher in at least one of them was compelled, with the consent of the principal, to open her windows and get coolness from the outside. As this interferes with the ventilation somewhere else, I inquired how they managed. The reply was that they did not manage. When they found they could not get low enough temperature without opening the windows they threw them open regardless of what it might do to the system.

I found a place at the rear of the last furnace where a door gave us access to the V-shaped space between

the tops of the fourth and fifth furnaces. Here we placed some ordinary wash boilers. By filling them with water the engineer found that he had about one-fifth less coal to wheel and shovel into the furnaces while the rooms were comfortable to teachers and pupils with a very much reduced temperature.

This scheme supplies moisture to the hot, dry air that passes over the furnace. If it should happen that any room will not require any warm air on a mild day, the air coming under the furnaces will not get any moisture, but probably the air so received into the room will be nearly the same in temperature as that of the outside air, and so there will be little need of humidity, it being already sufficiently saturated to make it safe to use. The entire humidifying outfit for that school cost so little that it is entirely inconsiderable.

Miss McGee writes enthusiastically about the greatly increased comfort of teachers and pupils and says they regard the improvement a very valuable one. As many pupils were absent at the time I visited the school and the reasons given generally were the contagious diseases then prevalent, it will be interesting to learn next winter whether contagion is not largely allayed by the use of right air which raises the powers of resistance in pupils and makes many immune to the so-called children's diseases.

CHAPTER XXI.

Chicago's Demonstration of the Value of Open Air to the Tuberculous.

Graham School, Chicago, Oct. 1, 1909.

Mrs. Ella Flagg Young,
Superintendent of Schools,
Chicago, Illinois.

Dear Madam:

I beg to submit herewith my report on the work of the Open-Air School held under my direction at the Harvard school building during August and part of September of this year.

Our object was to benefit the children sent to us and to make a demonstration of what fresh air during the day and proper food will do for children predisposed to tuberculosis. As the demonstration shows several important things connected with education aside from tubercular data, I shall give myself the pleasure of reporting rather generally, and respectfully refer those specially interested in tuberculosis to the report of Superintendent Frank E. Wing, of the Chicago Tuberculosis Institute, the body co-operating with the Board of Education and supplying food, car fares, nursing, and cooking.

Weak Children—We took children on the recommendation of the Tuberculosis Institute, such as responded to the tuberculin test or who were members of families where there were one or more persons afflicted with the

disease in an advanced stage. The age limits were ten to fourteen years, but we accepted a few children under ten where their brothers or sisters were in attendance.

These children were weak, generally stupid, backward, untruthful, unreliable, and almost subnormal if not quite so. Only one was as high in school as the seventh grade, and that one not in a public school. Two were bright in their school work and two others fairly competent. The others were in low grades and manifested slight interest in school work, as a rule. They were unable to perform certain portions of the work in the grades where they had been placed in the regular schools. I was surprised to find them so lacking in intelligence, for I had gathered the idea in some way that the consumptive child is usually bright, nervous, active, and much inclined to take culture.

I mention this misjudgment of mine because others are inclined to the same error. It arises from the fact that most of the children in this unfortunate class do not attract the attention which bright children get and the disease is not far enough advanced to manifest itself to the observer, and so the bulk of children who are really tuberculous are not known by their teachers or principals to be in any danger. We think they are naturally dull or born short mentally when the fact is they are ill.

A careful examination of the children in any school will uncover cases of the most urgent medical and sanitary need whose presence is not suspected by the school authorities. There is need of such an examination, not because of danger to other children, for the cases are not infectious at this stage, the most easily curable one, but it is extremely dangerous to let children slip down into a condition where their cases do become contagious and the prospect of a cure remote.

One of the most surprising features of our work was the ease with which we induced these weak but well looking children to recline in their invalid's chairs and relax. In most cases no relaxation could be induced the first day in the open air. On the second day, however, half the pupils were ready to rest. Later on, nearly all came to their chairs without any urging.

Incorrigibles—Proper feeding and out-door treatment do not in every instance improve the moral condition of the child. Some of these children have been out of joint with the world for so long a time that they are rebellious and resentful. As soon as the boys begin to feel increased vitality we are liable to have trouble with some of them. Any discipline given them seems to be ineffective and the only remedy found this summer was to remove them from the school and let others take their places. This is cruel to them, for they sorely need the school; but to the others admitted in their stead it is a boon.

I do not think the incorrigibles are by any means hopeless cases, but I mention this difficulty as one to be guarded against in future work and for which some remedy other than dismissal from the school should be provided. Anything like corporal punishment is out of the question, for if children were punished corporally in such a school they would have so little judgment when in passion over it that they would not take the punishment as corrective but as a form of persecution administered merely because the teacher is the stronger. I experimented enough to convince myself that almost any form of correction is regarded by the child as merely a part of the persecution which it suffers on every hand because it is weak and usually poor and neglected.

Some form of special rewards should be provided for

every day use, and the hope of reward and cheerful encouragement should be the means of upholding such discipline as is necessary to the school. It is imperative that the children be kept quiet at the time of relaxation. One child making noises or running about will upset others and prevent the success of the whole enterprise.

Remembering that these are sick children, although they may not and usually do not realize it, we must give them a form of discipline specially adapted to the perverted mind, a hopeful, cheerful, co-operative manner of getting ready obedience, a thing much more easily described than obtained.

Intellectual Advancement—Early in the summer Dr. Kohn visited us and stated that in order to make sure of hearty support for future work along these lines, it would be advisable to get from the children some mental work which would set them ahead in the grades when they should return to our regular schools. At first thought this was directly contrary to the purposes of the school. We could not hope to get the best physical improvement from children who had failed in school if we set them tasks daily and put them through the usual forms of recitation and study. But in view of the fact that, as a rule, a sick child cannot learn and the well child has an immense advantage, not only through greater ability but because of a real desire to learn, we concluded that it would be best to experiment cautiously along the line of mental effort and see if we could get results without impeding the physical progress of the cases.

I took each child separately and made an exmination of his powers. The results were tabulated for the use of the teachers in following a plan which I felt would be helpful rather than detrimental to the child in every way. Admitting to him freely that I firmly believed his failure

in certain subjects in school was due entirely to the condition of his health, I assured him that with the improvement his body was getting in the outdoor school he would probably find an increase of mental power coming to him without any particular effort on his part. I told him I wished to watch the growth of power in him, and that I should have his teachers on the lookout for the thing we desired to see come. This gave him hope. He had been called stupid before and he was not wanted in any school room, as a rule, until that time. Now every child seemed to see a way to become as other children, successful in regular school work.

The teachers were requested to take the data given them and offer to assist the child in anything he desired help on, doing the work every day at a stated time, never compelling any work, but merely assuming the air of one conferring a favor and at the same time looking for an interesting and gratifying improvement in mentality where mentality had formerly been low. This friendly conduct towards the child and the knowledge that the work given was not a task but a looking for coming ability, contributed to our success.

The children improved mentally as never before in their lives.

In the period of less than five weeks they were set forward in their regular grade work more than is customary with the average children in the ordinary school course in six months. I believe the improvement is permanent, and we shall know surely in a few weeks by inquiries at the schools to which the children have since been sent.

It is hardly fair to claim for the feeding and outdoor treatment all the benefits of this advance in grades, for I am sure that this method of raising hope and applying suitable assistance where most needed will work wonders

in any dull child without the help of the food and fresh air, if only the one directing the work and the one carrying it out can find some other reason to give themselves and the children for the expectation of marked improvement. Expecting marked improvement generally gets it when the child is taken into confidence in the matter. That is a general principle in education which is rather widely known and rather narrowly utilized.

In the hot weather of summer, in a remarkably torrid August, when the government reports show that an almost incredible amount of damage was done to the growing corn, a shrinkage of 330,000,000 bushels being the official estimate, we increased the weight by an average of four pounds each in these unfortunate children. This shows what an improvement may be made under adverse conditions. If we had had ordinary weather instead of this intensely warm spell with its attendant violent storms which disturbed the children considerably and reduced attendance, especially at the time our tent was blown down, we could undoubtedly have made a much greater physical improvement. If, in addition to this we could have kept the children in the tent over night instead of sending them to their poor and badly arranged homes with an average of ten miles of transportation daily, we could have done still better.

Lost Time. We lost some time at the beginning of the term, requiring one day to get the tent set and not getting all our pupils promptly. We lost two days at the close by the indiscretion of someone who thought the cases contagious and called on the Health Department to fumigate the building, thus preventing our closing exercises and losing Friday and Saturday of the last week. We were embarrassed by the blowing down of our tent, but fortunately no one was injured, as the pupils were not

in it at the time. Yet, in spite of all difficulties and the loss of half the summer before beginning the work which ought to have started early in vacation, or better still, in the early spring, it succeeded.

Recommendation—In view of the great advantages to tuberculous children who have received this treatment, I respectfully suggest that you recommend to the Board of Education to continue the experiment during the coming vacation of 1911, at least. Better still, I would recommend warmly the opening of an all-year open-air school for the tuberculous, take one of our unused buildings, such as that at Emerald avenue and 80th street, providing for cold rooms, proper shelter, sleeping equipment, services of teachers and care-takers during seven, or at least six days in the week, a good cook and helper, kitchen and dining room equipment, tents for warm weather, reclining chairs, cots, and plenty of rugs, sleeping bags, and bedding.

Such a school will not only keep up the work which I believe has saved thirty lives in thirty days, but extend its benign influence to many unfortunate children who probably will not die of tuberculosis, but who will become so weakened by the ordinary school treatment that their lives will be a burden to them and they a burden to the city and to their relatives and friends. These will be brought to such a state of resistance to disease that they will become healthy and useful citizens.

Other Advantages—By putting a large number of children out of the dependent class eventually through such a school we may relieve the city and county of far greater outlay than the work will cost.

By carrying on this work the Board of Education will ally itself with one of the greatest benefactions of the time, the effort to stamp out ultimately the white plague.

By taking these dull, irritable, and unsatisfactory

children out of the regular classes in the public schools the work there will be facilitated sufficiently to pay again all the costs of maintaining these out-door schools. The time and strength of teachers is largely consumed in the fruitless task of trying to teach and discipline these intractable and impossible pupils. Neither the teachers nor the pupils know the reasons why such trouble exists where they are kept in ordinary rooms and taught in ordinary classes, but there is great friction there which is unnecessary, very expensive, and detrimental to the health of both teacher and pupil. The trouble they bring into the ordinary school room is subversive of good order, and the cost of maintaining schools for them separately is more than wasted in our present administration, even if we set aside the welfare of the child and merely figure the cost.

How This Demonstration Points to Another—There is now going on in the Graham school a demonstration of the effect of making the prime object of school work a fitting of the child for mental development rather than actually doing the developing. The ordinary plan of keeping children in a warm room with very little freedom of action and no particular enthusiasm for anything is detrimental, especially in the low grades where the things taught are mere formal notions attached as a rule to symbols.

Fresh air, relaxation, actual sleep during the day where practicable, and joyous activity in a cold room where the desks have been taken out, tend to raise the vitality of the children, making them capable of throwing off, not only tuberculosis, but nearly all the diseases childhood is subject to.

This treatment has also a remarkable effect upon the power to learn. It is understood that there is very little

learning except where there is the inward pressure of desire to acquire knowledge. This pressure is absent in the weak body of the thin blooded child usually. By increasing the child's vitality, we not only put him in position to resist the advance of such diseases as are brought to his body daily, but we increase the psychological pressure of desire for acquisition.

I hope to be able to present a report within a few months on this similar work which I believe fully as important as the work done last summer out of doors with tuberculous children.

Respectfully yours,
W. E. WATT,
Principal.

Not long after the experiments with open-air rooms at the Graham school were begun, the principals of Chicago began taking note of the work, especially the principals of District No. 7 who had demanded that I make a demonstration of the kind of school I felt ought to be conducted at the public's expense.

Miss Minnie R. Cowan, district suprintendent of that district, watched the work closely and passed the word along that there were results there which ought to be understood by all. At one of her principals' meetings she caused the formation of a special committee on School Sanitation.

As the report of this committee is full of valuable references and I have taken pains not to give references in other parts of the work, believing they are liable to interfere with the perusal of the general reader, I give that report here in full. It contains the argument for better air and gives enough authority to satisfy those who prefer to do their thinking largely by means of following

what has been said by others who have gained a reputation for special knowledge.

Report to the Superintendent of Schools on School Room Temperature and Humidity.

The intellectual part of school work accomplished by children must be done on surplus vitality.

Nature demands most of the average child's current stock of vitality to meet the needs of normal physical growth and development.

Even the present improved school room conditions are altogether artificial, at best.

It is most conclusively shown by the testimony of expert medical, educational and scientific authorities quoted below that the work of pupils and teachers is being greatly reduced in efficiency and permanent injury to health caused during a large part of the year by the high temperature of 70 degrees and over combined with the excessively low relative humidity of the heated air ranging from 30 to as low as 20 per cent, a condition which tests will show is general in the schools. This, government officials assert, is drier than any climate known. It is fatal to plant and animal life if no relief and change is afforded.

In the bulletin of the Department of Health of November 19, 1904, Dr. Arthur M. Reynolds, then commissioner of health, in discussing this subject speaks as follows:

"Recently, Dr. Henry Mitchell Smith, of Brooklyn, read before the Brooklyn Medical Society a paper on 'Indoor Humidity,' which embodies the results of his years of study and of observation of the baleful effects of an over-heated and over-dry indoor atmosphere upon the health.

"The neglect of the element of watery vapor in the

air is the greatest cause of overheating our homes. A low humidity is the great cause of discomfort, the source of much ill health, catarrhs, colds, and other diseases of the skin, mucous membranes, etc.

"Tests conclusively proved that a percentage of moisture above 60, with a temperature of about 65 degrees, yields the greatest comfort and the best conditions for health. With a temperature of 72 or 74 degrees and a relative humidity of 30 per cent, as compared with a room at 65 to 68 degrees and a relative humidity of about 60 per cent, the latter seemed the warmer and more comfortable.

"Add to this the fact, pointed out by Professor Wilson, of Milwaukee, in a paper on 'Atmospheric Moisture and Artificial Heating,' and it will be seen that we are wasting fuel from the unnecessarily high temperature we maintain. The waste is probably greater than is generally supposed." Professor Wilson says: "About 25 per cent of the cost of heating is expended in raising the temperature from 60 degrees to 70 degrees, so if we can keep comfortable at a temperature of 65 degrees we shall have saved at least 12½ per cent of the total cost of heating.

"Dr. Smith has so repeatedly demonstrated the fact that an indoor temperature of 65 is more balmy and agreeable than a much higher temperature—provided there is sufficient humidity—that he declares it should be a cardinal rule that if a room at 68 degrees is not warm enough for any healthy person it is because the relative humidity is too low."

One point emphasized by Dr. Smith is that every time we step out of our houses during the winter season we pass from an atmosphere with a relative humidity of about 30 per cent into one with a relative humidity of, on

an average, 70 per cent. "Such a sharp and violent contrast must be productive of harm, particularly to the delicate mucous membranes of the upper air passages."

The remedy is to maintain the indoor humidity at the proper point—between 60 and 70 per cent.

An article on this subject in No. 1337 of the Scientific American Supplement, quotes from a report by Dr. W. M. Wilson, director of the United States weather bureau at New York. Director Wilson, who is a physician as well as a scientist, and who has given the matter careful study, says:

"It is safe to assume that during the winter months the normal relative humidity in lake cities is 72 per cent, and the average diurnal range is from 60 to 72 per cent. From observations with respect to moisture in business offices and living rooms heated by steam, hot water, and hot air, it is safe to assume that the average relative humidity in artificially heated dwellings and offices in the winter months is about 30 per cent, or about 42 per cent less than the average outside humidity, and drier than the driest climate known. The evaporation power of the air at a relative humidity of 30 per cent is very great, and, when the tissues and delicate membranes of the respiratory tract are subjected to the drying process, a corresponding increase of work is placed upon the mucous glands in order to keep the membranes in proper physiological condition. Nature in her effort to compensate for the lack of moisture in the air is obliged to increase the functional activity of the glands, and this increase of activity and the frequent unnatural stimulation, induced by the changing conditions of humidity from the moisture-laden air outside to the arid atmosphere inside our dwellings, finally results in an enlargement of the gland tissues, on the same principle that con-

stant exercise increases the size of any part of the animal organism. Not only do the glands become enlarged, but the membrane itself becomes thickened and harsh, and sooner or later the surface is prepared for the reception of the germs of diseases, which tend to develop under exposure to the constantly changing percentage of humidity.

"The medical authorities tell us that the 'Physiological symptoms of an atmosphere too dry are parched lips and tongue, a dry, feverish condition of the skin, and, in those children predestined to lung disease, a hacking cough, resulting from the desiccating effect of excessively dry air on the lungs and bronchial tubes."

On the economy of fuel consumption achieved by controlling humidity in the school room, Director Wilson says: "A humid atmosphere is economical. In a room in which the temperature is 72 degrees, the temperature of the wet-bulb is 54.5 degrees. If a room with a sensible temperature of 54.5 degrees is considered comfortable, the same result can be attained by heating to only 60 degrees, and supplying sufficient moisture to raise the humidity to 70 per cent, which still conforms very closely to the normal condition of the outside air, so far as moisture is concerned. It would probably be impracticable to maintain uniformly a relative humidity of 70 per cent, especially with a low outside temperature, as the condensation upon the windows would be undesirable; but by heating to 65 degrees the relative humidity could be held at 50 per cent without any ill effects, possibly on extremely cold days. Competent engineers estimate that about 25 per cent of the cost of heating could be saved by holding the temperature at 60 degrees and raising the humidity to 70 per cent, still maintaining a wet-bulb temperature of 54.5 degrees, the same as that

FILLING AND THRILLING.

BALL UP AND SPIRITS ELEVATED.

obtained by heating to 72 degrees under ordinary conditions. But to be conservative and avoid the possibility of any unpleasant results from condensation, our dwellings could be heated to 65 degrees with a relative humidity of 50 per cent and still save from 12½ to 15 per cent over the present cost."

Here, it ought to be explained why humidity will permit a lowering of the temperature without discomfort to the body. With a dry atmosphere the evaporation of the body is stronger than it is in a humid atmosphere. Consequently we feel cooler in a dry than in a moist atmosphere of the same temperature.

Dr. Frank Wells, of Boston, on page 8, "Lectures on School Hygiene" (Ginn & Co.), writes: "I have said that fresh air is not overheated air. Over-heated air is one of the great hygiene evils in the school room, an evil, because it is very potent in the causation of colds, and moreover, leads to an over-stimulation of the circulation in the brain and nervous centers, thereby producing defective visions, headaches and nervous debility, and depression."

Dr. C. Harrington, in his "Manual of Practical Hygiene for Physicians," pp. 441-442, states: "When outdoor air is heated so as to maintain an even temperature of 70 degrees F., but with no addition of water vapor, its capacity for absorbing moisture is very much increased. It will take it up from the skin, the mucous membranes of the mouth, nose, and respiratory tract; from furniture made from wood which in the process of kiln-drying was never brought to such dryness; and from plants, which in consequence will wither and die.

"It thus causes dryness of the skin, irritation of the throat, and cough. It causes also need of a higher temperature to give the same sensation of warmth and com-

fort as is the case with air containing a normal amount of moisture."

On the need of fresh, cool air for school pupils, we quote from an address by Dr. Henry Baird Favillc, of Chicago, before the National Education Association, at Denver, July 9, 1909 (N. E. A. Proceedings, p. 107), in which he said: "What I wish to emphasize is that there is neither logic nor justice in recognizing hygiene principles only for those who are ill. There are certain defects worth while to touch upon. Perhaps chief of these is the question of fresh air. None is more crucial. I cannot take time to go into detail. I must ask you to fill in the things I leave unsaid; but this I wish to say: The child should be educated to an abundance of fresh, cool air, fresher than it is accustomed to, cooler than is perhaps comfortable at first. If involving a process of hardening, why not? Please believe that I realize the difficulties in this suggestion. Obstruction, complaint, and criticism are inevitable. School architects and school authorities have not crossed the threshold of this proposition. No matter what the difficulties, it is an absolute necessity that this question be met. It will pay many fold, not only in health, but in educational results."

Stratton D. Brooks, superintendent of schools, Boston, before the National Council of Education meeting in Denver (N. E. A. Proceedings, 1909, p. 364), said: "The schools should do something for many hundreds of anaemic and sickly children, for whom the conditions in overcrowded, and especially in overheated, school rooms are unfavorable. The School-house Commission of Boston has been requested to provide each new building with fresh air rooms, so arranged that the heat may be shut off and the rooms filled with fresh outside air and flooded with sunlight. In these rooms, pupils who

would benefit from more fresh air, may be seated with slight additional administrative difficulty and no additional cost.

"In this connection it should be emphasized that teachers as a rule enjoy a higher temperature than is good for the children, and undoubtedly many rooms are kept overheated to the very great injury of both health and education of the children. Fewer colds and other illness, better discipline, and better work will result from a uniform temperature below seventy degrees than from above."

In the report on retardation of pupils in school, an investigation by the Russell Sage Foundation, it is claimed that in one of our large cities, named in the report, there is an annual loss of school funds from this cause of over $2,000,000, out of an expenditure of $12,000,000.

The loss to the children and to the state due to failure of these laggards to secure an education is of course incalculable.

In a report by James M. Greenwood, superintendent of schools, Kansas City, Missouri, on retardation of pupils, he shows, from investigations made, that by far the greatest cause of retardation is time lost on account of illness. That most such absences are caused by throat troubles is shown by a record, taken at random, of exclusions by the school medical inspector of pupils from the 13 highest rooms of a Chicago school from November 8 to December 9. The total number excluded was 28; of those 26 were excluded for throat troubles, viz.: tonsilitis, bronchitis, and pharyngitis, while only two were excluded for other diseases. The temperature of the rooms was 70 degrees and upward and the relative humidity low.

This taken in connection with the statements by authorities quoted in this report, of the harmful effect on the respiratory tract of dry, heated air, is significant. In many cases of anaemic, under-nourished children of the poorer districts, adenoids, enlarged tonsils, and catarrhal trouble are very prevalent, and retard the pupils' progress in school. A committee of the Citizens' Association, in a report made in 1885 on heating and ventilation of school buildings of Chicago, recommended that water be evaporated into the warm air or that it be sprayed in. The schools still have no such provision and are supplied with air with a relative humidity, recently shown by hygrometer tests to be as low as 20 per cent. The health department states it should be from 50 to 70 per cent.

The efficiency of the schools largely determines the welfare and success of the future men and women of the nation. The safeguarding of the vigor and health of pupils and teachers is fundamental, ethically as well as economically.

That retardation in scholarship, lowered vitality, stunted growth, arrested mental development, and permanent injury to health must result from a child's being obliged to spend long hours each day during eight or more years of the most plastic period of life in an atmosphere and environment proven to be injurious and harmful to health is scarcely to be questioned.

It is important to bear in mind how much more susceptible are children to morbific conditions than are adults. This and other matters relating to the safeguarding of the health of pupils urgently demand the most serious consideration. The report of Mr. W. E. Watt, given below of his investigations in the Graham school, and his success in remedying the conditions there shows

that the needed improvement can be accomplished at an actual saving of expense in the end.

Respectfully submitted,

J. A. JOHNSON, Chairman,
IDA M. COOK,
JEANNETTE I. PRATT,
WM. E. WATT.

Committee on School Sanitation.

CHAPTER XXII.

Ionized Air and Radiant Matter.

From sunshine we get heat and light. Not always directly, for the coal measures have preserved them for ages and some of our light is shot back at us from the moon. I suspect that all other forces come from the same source, though frequently by way of the rear of Robin Hood's barn. Recent developments make me guess that the sun supplies us with all chemical activity, as well as electric, magnetic, and radiant doings.

Only yesterday we were shocked into knowing that it is no longer proper to speak of the sun's actinic rays, for all rays are actinic; and the correct language to use in speaking of what is done by the invisible, impalpable short rays of sunlight is, "actinic effects of the solar radiation."

When the sun shines we see its light and feel its heat. The heat waves are long, the light waves short and more rapid. But our spectrum shows shorter and quicker rays which cannot be seen or felt merely because we have no nerve senses tuned to their vibration. Chemists and physicists unite in admitting that these short rays, the ultra-violet, are as powerful and as important to us as are the heat and light rays.

These short rays are wonderfully beneficial to the human body, and they are also dangerous when their stimuli are applied too extensively. Cancer is easily

killed by them. Tuberculosis and all germ diseases succumb to their power. Yet when the white man, the man with but partially pigmented skin, goes into the tropics, these unseen and unfelt rays kill or cripple him in a short time unless he guards against their secret influences.

Ultra-violet rays are so deadly that when we visit in India one of the greatest kindnesses done for us by our hosts is to make sure that no sunlight is permitted to rest upon our heads even by reflection. The stranger in India does not know his peril and he may receive his death blow in the apparently gentle arrow of sunshine that comes streaming through an opening in the foliage or the house and falls unperceived upon his head.

Woodruff, who has seen many unnecessary tropical deaths, speaks of our lack of nerve sense in the following words: "It is an unsolved mystery why there should be no human nerve apparatus to receive impressions from the harmful ultra-violet, while we can perceive the slower rates by sight or temperature sense. If the heat sense was evolved because those having it were guided from harmful to beneficial temperatures, why did we not evolve a pain sense to guide us away from harmful sun's rays—like the ants and lower organisms generally?

"The only hint we have is in the supposition that man and his ancestors evolved in dark, rainy, misty, cloudy regions. Such an atmosphere is proved to filter out the ultra-violet rays, and even today though they are very powerful at mountain tops they are mostly destroyed by the atmosphere before they reach the valley. Hence there was no nerve sense evolved, as there was no need of it, but evolution later took the direction of throwing out a pigment and this resulted in the survival of the pigmented and the death of the unpigmented when ultra-

violet did enter the environment. It was too late to evolve by variation a new nerve sense, and survival could then occur only in one way—that is, by excluding the harm which was not sensibly appreciated. Hence our present ignorance of the injury we receive when out of our proper zone."

Iron in the blood is increased, says he, by ultra-violet. "In high altitudes, where there is more ultra-violet than at lower levels, there is an increase of iron in the blood. Burker found it increased twenty-five per cent in the physiological laboratory at Tübingen, and Gaule and others found increase of red blood cells in men during balloon trips."

Light stimulates circulation, metabolism, and sweat secretion, and light baths are valuable in diseases needing stimulation of metabolism. It is beyond us to estimate to what extent light cures will be carried out in the near future, but the popular mind has but feeble conception of how we are affected by the sunlight which comes directly upon us or which is reflected to us in the diffused light of day or the illuminations which we enjoy at night.

We know that heat rays penetrate all substances, but we are not so certain as to what happens to the human body in the sunshine in regard to the light rays and the still shorter and quicker which we neither see nor feel at the time.

One of the greatest wonders of my boyhood was the performance of a lad who enjoyed making a living jack o' lantern of his own head by moving a lighted candle at arm's length till its flame was small, plunging the flaming end into his mouth, distending his cheeks with pent up breath, and allowing the candle to burn feebly for a few seconds inside his mouth while his features were

illuminated from within so that, in a dimly lighted room, he presented a most grotesque and remarkable aspect to his profoundly admiring friends.

Sunlight reaches the brain in an equally surprising volume. Woodruff says: "We rarely appreciate how transparent the scalp and skull really are. A candle in an empty skull shines through quite plainly. Hence a hairless head would permit strong light to penetrate to the delicate nerve cells which are here directly on the surface and it would be fatal. The greater amount of light there is in a country the thicker and blacker is the head hair. It is perfectly evident why the ancient European's wavy hair should become more and more kinky as man slowly migrates south, for it is thus a better protection from light. There is then no enigma in the apparently useless masses of kinky hair of the negro. The hair is not needed as a protection from the heat, or cold, for it is profuse in all countries, but it is a protection from the light."

The short waves of sunlight kill bacteria. This has been known for years. Most of the fatal diseases and the weakening agencies which prey upon the human race may be killed by these short waves.

They are not little animals, although scientific men once called these germs animalculae. That is merely one of our old errors. They are vegetables rather. They are forms of protoplasm.

But when we began to kill them with X-rays we used too much and killed off not only the bacteria, but much of the protoplasm of the patient. Many suffered great torture before medical science learned to use less of the X-ray so as to injure the bacteria only and to stimulate the protoplasm of the patient. A gentle application of the X-ray gives the body the upper hand of the microbe

and it does its own killing. The tissues and the antitoxins do the killing and the body is not harmed.

From the standpoint of the physiologist and the physician the X-ray and the ultra-violet are the same.

What we desire in school is an admixture of light which will permit the ultra-violet to do its stimulating of tissues in the child and its weakening of the germs so the tissues and naturally formed antitoxins may remove any harmful bacilli that may be present, including also the toxin of fatigue, which may be carried off readily when the system is well filled with anti-bodies and we say the resistance to disease is well up.

Although too much sunlight is harmful—even fatal in certain instances—for children of this zone our natural sunlight, especially our reflected daylight of the open-air school, has been demonstrated to be highly beneficial physically, mentally, and morally.

The molecule and the atom were a short time ago the limits of physics and chemistry. The molecule of any substance was considered such a small thing that it could not be separated or divided further and retain its character. It might be separated chemically into atoms of elements, but this division destroyed the molecule and the character of the substance.

The disintegration of molecules is frequently attended with a production of heat, magnetism, or electricity, and molecular breaking up has shown us forces which are mighty, but which a short time ago were undreamed of. And the speed with which these segregated bodies travel caused Faraday to call them ions, from the Greek verb to go. Those which in electrolysis run up stream in the electric current to the anode were named by him anions, and those going down stream to gather about the cathode he called cations.

Throughout nature these ions abound and seem to form the connecting link between life and death. Dr. William Tibbles says: "We may find that ions derived from chemically organic substances, hitherto classed as dead matter, already exhibit some of the characteristics of living matter. It is not considered that ions are actually living substances; but that they are in a condition in which the characteristics of vital matter may readily be developed. We may find that the process of vitalizing matter is evolutionary. That life is not conferred upon gross inorganic matter, but the living matter assimilates ions of various kinds, and that ions alone constitute matter which is ready for organization."

And within the past few weeks we find that ions have been separated and held under observation for an hour at a stretch. We are coming close to a great secret of nature whose workings have been partially recognized for years, but which has but now been recognized through a glass darkly.

An American physician was taken with severe toothache while in London last winter. He sought an American dentist, who explained that he wished to treat the tooth by the method he had recently learned in New York. He passed into the tooth a zinc needle attached to the positive wire of a light electric battery, the negative being placed in the patient's hand.

Soon the pain ceased and the dentist said: "We have ionized the tooth and antisepticized it." The micro-organisms in the tooth were removed and no discomfort has returned.

Ions travel rapidly, even furiously. They carry electricity, both positive and negative. They antisepticize. They almost make that which is dead alive. They carry

to the living organism building material which it can use.

Shutting children in a house hermetically sealed and pumping devitalized air to them devitalizes the children. In London, Dr. L. D. Rogers reports that the Middlesex and St. Thomas hospitals have operating rooms which are vacuum tight and the air admitted is passed through wool and water to remove everything of a septic character, but although the air is sweet and pure and an abundance of light is given, the nurses regularly acquire pronounced anaemia. Deprived of the invigorating qualities of air as provided by nature they lose weight and strength.

Oxygen is freed in natural air, especially in cold weather and during electric storms. This is ozone. Ozone is oxygen ionized, bearing electrical energy and best fitted for the upbuilding of living organisms. It is astounding that our ventilating systems generally are constructed and operated so as to rob our lungs and blood of this most valuable constituent of out-door air.

Smaller than ions, infinitely smaller, more active, and incalculably more powerful are the emanations of the atoms of radium, thorium, and other elements of this radiating group which carry on a never-ending bombardment of astounding vigor and subtlety.

We have passed down beyond the realms of chemistry now to the new field of physics, which is much more subtle and wonder-producing than chemistry. The step from the limits of what we considered physics a few years ago to the limits of chemistry, from the molecule to the atom, is but a very inconsiderable one compared with the plunge science now gives us into the realm of the radiating atom.

The disintegration of the molecule is too great in

marvels of forces and activity for the mind to grasp; but the disintegration of the atom and its radiant material and force exceed the limits of human comprehension infinitely more than do the wonders of the breaking up of atoms.

We are now inculpable if we suspect that all matter is one after all our hooting at the alchemists. Radium and thorium pop away at a furious rate and produce helium. Each is an element and each produces a third element! Perhaps the different elements are different forms of vibration and radiation! But this is aside from our present purpose, except that it opens the mind to the virgin fields of science which are yet to produce greater wonders than any we have seen.

Sunlight brings us, if not life itself, a flood of those activities which must be present to support life. The actinic effects of sunshine are not all at the short-ray end of the spectrum. The infra-red rays, the long slow ones, heat, have always been used by men. The ultra-violet rays, the short, quick ones, being unperceived by any of our senses, have escaped our study until recently.

Our greatest source of living power may not be the sun after all. At least, it has not come from the sun in the last several million years. From the earth come unseen emanations which, although unseen, unfelt, and until recently unknown, do more than sunshine in promoting life. In many caves and cellars Elster and Geitel found that air long confined was very rich in radium emanations. They showed that the earth's crust, its soils and rocks, and especially clay, throw off radium emanations. J. J. Thomson found deep wells and springs rich in the same. Elster and Geitel took radium from sediment of hot springs, and Blanc found thorium ema-

nations in the same way. Even petroleum has been found to yield radium.

Professor Rutherford says: "There appears to be no reasonable doubt that the earth is the source of the emanation in the atmosphere. This emanation escapes from the soil by the process of diffusion, or is borne to the surface in spring water and is then distributed by the winds. * * * This radio-active matter must be continuously supplying heat to the earth, and it is of great interest to examine the magnitude of this heating effect and its probable bearing on the question of the origin and duration of the earth's internal heat. * * * Radium gives out heat continuously and uniformly at a rapid rate. A quantity of radium supplies enough heat to melt more than its weight of ice per hour. A pound of radium in the course of a year will emit as much heat as that resulting from the combustion of 100 pounds of good coal. This heat emission of radium and of all the radioactive bodies is in reality a secondary property, for it is a consequence of the bombardment of the active matter by the alpha particles expelled from its own mass. The beta and gamma rays produce only a small percentage of the total heating effect."

He states that the radium is being consumed, and that a lump of it will while acting for 20,000 years nearly all pass away. Fortunately radium is produced by the transformation of uranium, and while we are losing the radium of the earth's crust by its own activity, uranium is supplying more all the time, and it takes uranium at least two thousand million years to pass over into radium. He finds in this radioactivity a sufficient source of heat to prevent the earth's cooling down perceptibly, and in fact hints that it may be the cause of its becoming somewhat warmer instead of cooling at all.

He further shows how by calculating the times of transformation of radium and uranium a new computation may be made of the age of the earth since it was a molten mass.

"I hope that I have made clear to you how the study of radioactivity has profoundly altered our views of the earth's internal heat. The conclusions advanced are by no means completely proved, but sufficient has been done to cast grave doubt on the validity of the older theories of the origin and variation of the earth's internal heat." (Sci. Am. Sup. No. 1740, pp. 298-9.)

Although I have often quoted Professor Tyndall's statement that were the moisture in the atmosphere removed for a single summer night all vegetation that frost can kill would be dead in the morning, I am satisfied he was wrong. The earth's heat is not directly derived from the sun and it cannot escape so promptly under any atmospheric conditions. I have tested the air in Canada where Arctic trade winds have swept all clouds from the sky and covered the earth with a current which contained no measurable humidity at all. A continuance of this dry, cold wind for several days has not brought frost either by day or night in summer time. Yet Tyndall's reasoning is right to a less extent than that to which he carried it, and it is useful in calling attention strongly to the effects of dry air on the human body by permitting rapid loss of heat.

Where the air is dry from the grand operations of nature its effects are quite different from those where the dryness is brought about by a devitalizing artificial process. It is important that the magnetic properties of air be retained, that ozone be held in it, and that the radioactivities be not interfered with, if we are to get health and strength from breathing it. Open air retains

them, while air warmed and dried artificially usually totally destroys them.

Heat is among the least valuable of the results of radioactivity, of living in open air. While radium warms the earth, it does much more, and he who lives where these rays may operate naturally upon him is not only warmed by them—made capable of withstanding cold—but is given physical and mental power and a wonderful resistance to disease.

The growth of vegetation and animal life is entirely dependent on these emanations. We have so long depended on sunlight, moisture, fertilizers, and foods that we are accustomed to thinking of them as the causes of all growth and development. Now we are beginning to learn the finer and more elusive truth regarding the laws of life, and in them we see how artificial heat and prevention of radioactivity are making mankind more and more subject to disease and weakness and causing a deteriorization of the race which must be checked at whatever cost.

VITALITY BY WAY OF THE NOSE.

CHAPTER XXIII.

The Human Body a Transformer.

The muzzle velocity of a cannon ball is far less than one mile a second. But we consider its motion rapid. We are not able to think of matter as moving 10,000 miles a second. But Frederick Soddy says: "Alpha particles shoot off from radium at this great rate and pass directly through everything they meet. When an alpha particle meets an atom of gas or fluid it ionizes it, sometimes positively and sometimes negatively, according to the substance met. Atomic disintegration is a sufficient, if not the actual primary source of all natural energy. Probably the earth is not a cooling globe. There is radium enough in the crust to form any conceivable amount of mountain ranges and set off earthquakes and volcanoes in mere sport. The energy evolved by disintegration of atoms is a million-fold greater than that produced by the most potent chemical change."

Our senses are too obtuse to notify us of these great activities. We know about the grosser changes, but the finest and by far the most powerful ones escape our notice because we are not fitted by nature to recognize them and we have but recently found out how to note their effects.

We are accustomed to think of elements in chemistry as fixed substances. Professor Rutherford, in debate with Sir William Ramsay before the British Association

recently, said he had found that the alpha particle shot off from radium is a helium atom, and he showed how the newly found elements transform one into another. By splitting off two alpha particles uranium passes into Bolton's ionium; then by splitting off further alpha particles comes radium A, then radium B and C, and ultimately lead.

"The philosopher's stone," says Soddy, "was accredited the power not only of transmuting the metals, but of acting as the elixir of life. Now, whatever the origin of this apparently meaningless jumble of ideas may have been, it is really a perfect and but very slightly allegorical expression of the actual present views we hold today."

Sir Oliver Lodge goes so far as to say that "all matter is electricity and nothing else."

Now, it is not important in the consideration of natural outdoor air whether all elements may some day be resolved into each other, whether metals may be transformed as lead to silver, silver to gold, and whether there is something like the philosopher's stone which does this and also gives protracted life. But it is very important that we know more about these fine and inconceivably powerful activities, for they touch our life. If the average of human life may be prolonged, as I hope to live to see it, more than twenty years by proper regard for radioactivity; if pain, illness, weakness, and much mental anguish may largely be alleviated or abolished by it, and if the intelligent population of the civilized world may be doubled and happified as prolonging life and healing it will do, then it is very important that we discuss, experiment, study, succeed, and fail in this great field until our ignorance is overcome and the way of life more truly learned.

The body is an internal slow-combustion engine. "The Great Engineer," says Dr. Wm. F. Colbert, "when he designed man, planned that man should be a complete power plant, the source of power being an internal slow-combustion engine. The fuel for that engine is food. The supporter of combustion is oxygen, and you can no more expect the human engine to do good work on rebreathed air than you could expect to successfully operate an internal combustion engine by sending the consumed gases back to the carbureter to be used over again. As surely as that is done in an internal combustion engine, the cylinders become encrusted with carbon from incomplete combustion. In the human being the accumulation of waste matters either brings about a profound auto-intoxication, or enables some pathogenic organism to secure a good hold on the body."

Now, that is a mechanical way of taking hold of the truth, but I believe there is a larger way. There is something vastly finer in the body than the consumption of food and the expulsion of waste. There is a taking up of ionized substances, things made alive by electricity, minute atoms magnetic, or inconceivably small particles of pure, independent electricity, and using them to promote living, acting, and thinking.

Long ago Stallo wrote: "Space is constantly traversed in all directions by streams of infinitely small bodies, moving with almost infinite velocity and coming from unknown regions of the universe. These bodies are termed ultra mundane corpuscles. By reason of their minuteness they rarely, if ever, collide, and the greater part of them find ready passage through ordinary sensible bodies. Sensible bodies—those in the interior as well as those on the surface—are equally liable to be struck by the corpuscles, the force of the impact being propor-

tioned, not to the surface, but to the mass of the bodies."

Modern thought agrees with Stallo. The radioactivity we now know corresponds with the activity he described, and his ultra mundane corpuscles are now called ions, electrons, metabolons, etc.

Professor A. S. Eve says: "The number of ions constantly being produced in the atmosphere by the earth's radium, or other causes, is reckoned to be approximately 10 ions per second per cubic centimeter—600 per minute —an estimate which agrees satisfactorily with those made from similar observations in other localities."

Professor Ernest Rutherford says: "We must bear in mind that all of us are continuously inhaling the radium and thorium emanations and their products and ionized air. In addition we are continuously undergoing a type of mild X-ray treatment, for the beta and gamma rays from the earth and atmosphere continuously pass into and through our bodies. We are in fact subjected to continual bombardment by the radiations of active matter and are fortunately quite unaware of it. Some have considered that possibly the presence of radioactive matter and ionized air in the atmosphere may play some part in physiological processes."

My own experiments with children and teachers supplied with air replete with radium emanations and ionized air satisfy me that they do play a most important and vital part in physiological as well as intellectual and ethical processes.

I have seen Doctor E. Stillman Bailey treat a patient with radium in such a manner as to change lupus, an open sore spot, into a healthy condition of tissue within three days. His discovery of another substance less expensive than radium which supplies health-giving and pain-allaying radioactivities will be a great boon to man-

kind. And I was highly gratified when I had related to him my belief that by supplying school children with natural air I was giving them from within their lungs a mild form of X-ray treatment which cures diseases and stimulates the tissues, he told me I was entirely correct in theory and hoped further experiments might make the matter one of common knowledge in education.

Air becomes devitalized in certain forms of house-warming and ventilation. This is common knowledge, but how it is done is not generally understood. I wrote Mr. William R. Macdonald, of Pittsburg, for an explanation. which follows:

"In my endeavor to answer the question of the critical temperature at which normal air is devitalized I will give you some of my observations during a practical experience of nearly forty years as a mechanic in the art of installing air-warming apparatus in residences. I have received two silver medals and one diploma for my work, and have endeavored to be progressive, but I regard my best efforts as having become obsolete as viewed in the new light of this progressive age.

"I read long ago that the French government interdicts the use of cast iron in hot-air furnaces, because of its porous nature, which permits the gases of combustion to devitalize the air in the hot-air chamber.

"I observed in my experience that sheet metal heaters having ample heating surfaces and never heated to red heat are by far the most effective; while hot-air furnaces of scant surfaces, heated red hot, deliver air at scorching temperature but with less volume and velocity. The mild air of the first heater moves with pressure. The hot air of the second depends on draught, and this is variable, one hot-air pipe robbing another and vice versa. The mild heat of No. 1 warms conservatories without

injury to plants. The hot air of No. 2 has a bad effect on wood finish and furniture, causing dryness and shrinkage.

"Faraday says iron is always and in almost all states magnetic. The school text books now state that when a magnetized bar is heated to redness it is found that it entirely loses its magnetism. One authority says that the magnetism of iron being heated increases as the temperature rises until it reaches redness, when its magnetism falls to zero. Faraday also says: 'The atmosphere is, in common phrase, a highly magnetic medium.' In his Experimental Researches, Vol. 3, p. 174, he says: 'All the experiments, whether of flame, smoke, or air, seemed to show that air has a distinct magnetic relation which, though highly affected by temperature, still belongs to it at all temperatures.'

"It seems to me this is what you are in search of: If the iron is demagnetized by over-heating, it follows that air, being highly magnetic, or radioactive, as the term is now, would at least in considerable degree lose its energy also, by over-heating, and become devitalized.

"We must assume that common iron becomes pyromagnetic at say 900 degrees F. and gives off its energy to the air coming in actual contact; but if overheated and its energy lost, the air in contact gains nothing and must sustain loss, and therefore possesses less vital force to be transmitted to the human transformer.

"Sir Oliver Lodge, in 'Electron History,' which I send you, mentions electro negative atoms which are non-metal and electro positive atoms which are the metals. So, you see, Faraday continues to be confirmed by up-to-date highest authorities. Here are two sources of energy, the metals and the non-metals—two states of matter, the solid and the aeriform. And the aeriform

will in time rank first in classification and general importance.

"An important advance was made when Professor A. S. Eve, of McGill University, measured the ions in the atmosphere at normal temperatures. And later, when Professor Rutherford of the same university declared: 'We are continually inhaling radium emanation, but are ignorant of physical results therefrom.' There was only the one proof lacking, and that you have supplied in your Graham school experiments. The results will be far-reaching, not only as regards health, but also in the economy in construction of schools and hospitals."

What radiant matter is, or what is magnetism, is not for us to discuss at present. We know that the great advocate of radiant matter, Sir William Crookes, "could venture the opinion" "that we are brought face to face with matter in a fourth state or condition," neither solid, liquid, nor gaseous.

He says: "In studying the fourth state of radiant matter, we seem to have within our grasp, and subject to our control, the little invisible particles which, with good warrant, are supposed to constitute the physical basis of the universe." "We have seen that in some of its properties, radiant matter is as material as this table, while in other properties it almost assumes the character of radiant energy."

"We have actually touched the border land where matter and force seem to merge into one another. The shadowy realm between known and unknown, which for me has always had peculiar temptations. I venture to think that the greatest scientific problems of the future will find their solutions in this border land, and even beyond; here, it seems to me, lie ultimate realities, subtle, far-reaching, and wonderful."

The human body has use for these refined but powerful forces. It can get them in the open air. The practice of civilization at present is to cut these beneficent activities off, to wall people in and to treat the air with hot iron so it loses its radiant powers. This depletes our vigor and shortens our life between twenty-five and fifty per cent on the average. The greatest question of state, of society, of education, of religion, and of humanity today is the restoration to the bodies of our coming citizens their rightful measure of radioactivity. This will save life, prolong life, and make life worth living.

I must not leave this great subject without saying something of the effect of radioactivity upon mind and of mind upon radioactivity. I have necessarily kept close to the physical side of the subject in order to secure an audience. Now I wish to state that I am convinced there is as much to be gained spiritually from free employment of open air with its radioactivity as is to be gained physiologically.

Radioactivity and magnetism are closely related if not identical. The electric action of ions and the magnetic qualities of the substance in which they are at work seem to be two sides of the same thing. The human body converts electricity into magnetism and reverses the process in the interest of life and growth.

The human body is a step-up transformer. Mr. Macdonald writes: "If it is true that atoms and sub-atoms are dynamic individuals, and if the human body is an aggregation of atoms, and therefore a storage battery of positive and negative electros, we may also consider the human as a combined step-up transformer and electromotive body.

"The current in the human is induced by the atmospheric electricity, and the atmospheric electricity is in-

duced by the radioactive elements or emanations of the earth's radium and other causes. Switch off his air-supply connections and he is at rest.

"You have shown that the human transformer possesses a higher degree of activity and intelligence when the motion is induced by outside air. Vital statistics and the common hot-air furnace have already proved that air, like a magnet, when overheated loses its vitality (magnetism), and Dr. Steinmetz demonstrates that magnetism and electricity are one and the same thing, the difference being only in the velocity of oscillation of electrons."

Emotions and other stimuli deflect the needle of the galvanometer. This has long puzzled workers in the field of abnormal psychology. Tarchanov first showed galvanometric deflections caused by states of mind. Féré, Sommer, Jung, Binswanger and others confirmed and followed him. They attributed the deflections to changes in the nerves, skin secretion, and capillary action.

American experimenters, Boris Sidis and Nelson, avoided their error. The galvanic phenomena were shown by them to be due to an electro-motive force in the muscles. They are due to the action of newly-generated electro-motive force within the body. (Psychological Review, Sept., 1908, and Jan., 1909.)

"A merry heart doeth good like a medicine." Let us step out of the paths of demonstrable science to consider something higher still which acts with control over these magnetic forces. It is the attitude of the mind. President Henry Churchill King says, in his book on Rational Living: "We must persistently aim, then, at surplus nervous energy, at what Emerson calls 'plus health.'" He further states that joy is a source of power. We have been showing that power produces joy—that radioactiv-

ity taken into the lungs with open air gives us happiness and the power to be happy. Let us consider his idea:

"**The Stimulating Effect of Joyful Emotions.**—The observations of physiological psychology show that joyful emotions have a positively stimulating effect, bodily and mental. Henle's researches proved that joyful emotions relax the muscles of the arteries and of the bronchial tubes, quickening the circulation and making respiration freer, and this without the evil consequences which attend anger, though anger, also, relaxes the same muscles. The depressing emotions, on the other hand, like sorrow and fear, contract the arterial and bronchial muscles and so distinctly interfere with both the circulation and breathing. It was long ago observed that blood flowed from an open wound more freely at the sound of music. Recent experiments on hypnotic subjects fully confirm these bodily results of the emotions."

"Joy," he further asserts, "directly increases our vitality. Greater vitality gives greater sense of reality. This means stronger convictions. Of convictions purposes are born. And conviction and purpose make influence certain."

Whether we toil or take our pleasure, whether we are training the young or caring for the aged, whether our work is mental or physical, the truth is open and applicable to all that our work, our worship, and our recreation should all be performed in open air and in cheerfulness. How much this truth is going to modify custom, architecture, and method remains to be seen. I am convinced it will permeate society and do more to alleviate suffering and uplift the masses than any other humanly directed agency.

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